U.S. EPA REGION 10

Biological Evaluation of the PotlatchDeltic St. Maries Complex National Pollutant Discharge Elimination System (NPDES) Permit

NPDES Permit No.: ID0000019

Water Division

7/21/2020

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Executive Summary

The U.S. Environmental Protection Agency conducted a biological evaluation to identify potential impacts to federally listed endangered or threatened species that could result from the reissuance of the National Pollutant Discharge Elimination System (NPDES) permit to the PotlatchDeltic Land and Lumber St. Maries Complex in St. Maries, Idaho.

The St. Maries Complex encompasses 160 acres on the Coeur d'Alene Reservation and consists of a lumber mill, plywood plant, power plant, wet and dry log storage yards, and a woody debris storage area. The proposed action is the issuance of an individual NPDES permit authorizing the discharge of non-contact cooling water, stormwater, and log yard runoff from outfall 001. The facility also has three additional outfalls which discharge stormwater; these stormwater discharges will continue to be permitted under EPA's Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP).

The maximum effluent flow rate for Outfall 001 is 1.1 mgd. Treatment for Outfall 001 consists of screening to remove floating debris and addition of a defoamer. The facility discharges within the boundaries of the Coeur d'Alene Reservation, however, the facility is owned by PotlatchDeltic Corporation, a non-Tribal entity.

The EPA's Proposed Action places effluent limits on the discharges of iron, pH, total suspended solids (TSS), and zinc and prohibits the discharge of debris, meaning woody material such as bark, twigs, branches, heartwood or sapwood that will not pass through a 2.54 cm (1.0 in) diameter round opening.

According to the USFWS species list Information for Planning and Consultation and the NOAA Fisheries Protected Resource App, the following federally listed species and designated critical habitat are in the vicinity of the discharge:

- Endangered Species
  - None
- Threatened Species
  - Bull Trout, *Salvelinus confluentus*
- Proposed Threatened Species
  - North American Wolverine, *Gulo gulo luscus*
- Critical Habitat
  - Bull Trout, *Salvelinus confluentus*
- Proposed Critical Habitat
  - None

The EPA has determined that reissuance of the Permit for the PotlatchDeltic St. Maries Complex will have NO EFFECT on the proposed threatened North American Wolverine, is NOT LIKELY to adversely affect the threatened bull trout, and NOT LIKELY to adversely affect critical habitat for the bull trout.

The Permit requires monitoring of the effluent and the receiving water to gauge the extent to which discharged pollutants may impact the environment, including endangered species.

1 Introduction

Commented [SSP1]: Prior to the Intro, please provide a list of acronyms and other shorthand abbreviations (e.g., LC05).

The U.S. Environmental Protection Agency (EPA) Region 10 is reissuing a National Pollutant Discharge Elimination System (NPDES) permit (hereafter "Permit" or "the EPA's Proposed Action") for Outfall 001 at the PotlatchDeltic Land and Lumber St. Maries Complex in St. Maries, Idaho.

The St. Maries Complex encompasses 160 acres on the Coeur d'Alene Reservation and consists of a lumber mill, plywood plant, power plant, wet and dry log storage yards, and a woody debris storage area. In addition to Outfall 001, which will be permitted under the reissued individual NPDES permit, the facility also has three additional outfalls which discharge stormwater; these stormwater discharges will continue to be permitted under EPA's Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP).[1]

The maximum effluent flow rate for Outfall 001 is 1.1 mgd. Treatment for Outfall 001 consists of screening to remove floating debris and addition of a defoamer.

The facility discharges within the boundaries of the Coeur d'Alene Reservation, however, the facility is owned by PotlatchDeltic Corporation, a non-Tribal entity.

The EPA's Proposed Action places effluent limits on the discharges of iron, pH, total suspended solids (TSS), and zinc and prohibits the discharge of debris, meaning woody material such as bark, twigs, branches, heartwood or sapwood that will not pass through a 2.54 cm (1.0 in) diameter round opening.

The Endangered Species Act (ESA) requires federal agencies to consult with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) if the federal agency's actions could beneficially or adversely affect any threatened or endangered species or their critical habitat. In this case, the federal agency is the Environmental Protection Agency (EPA), and the discretionary action is the reissuance of the Permit. The action evaluated in this Biological Evaluation (BE) could affect species under the jurisdiction of USFWS. This BE identifies endangered, threatened, and proposed species and critical habitat in the project area and assesses potential effects to these species that may result from the discharge authorized in the Permit.

The following major discussions are provided in this evaluation using the best data available:

- An overview of EPA's Proposed Action including a detailed description of the facility and proposed effluent limitations and monitoring requirements;
- A description of the action area and discussion of applicable water quality standards;
- A listing and discussion of ESA species that may occur in the action area;
- A discussion of the environmental baseline against which any effects of EPA's Proposed Action may be assessed; and
- An analysis of the effects of EPA's Proposed Action on ESA species within the action area, including Permit conditions that mitigate impacts of the proposed action on ESA species.

[1] https://www.epa.gov/npdes/stormwater-discharges-industrial-activities

2 Description of Action

Section 301(a) of the Clean Water Act (CWA) prohibits the discharge of pollutants except in compliance with CWA Section 402, among other sections. Section 402 authorizes the issuance of NPDES permits for direct dischargers (i.e., existing or new industrial facilities that discharge process wastewaters from any point source into receiving waters). An NPDES permit is developed to control the discharge using technology-based effluent limitations, which, in this case, are based on effluent limit guidelines at 40 CFR 429 and water quality-based effluent limitations (WQBELs).

Technology-based effluent limits may be established through application of EPA-promulgated effluent limit guidelines (ELGs), or on a case-by-case basis under Section 402(a)(1) of the CWA (these are referred to as best professional judgment or BPJ effluent limitations), or through a combination of these methods (40 CFR 125.3(c)).

EPA has promulgated ELGs for the timber products processing point source category in 40 CFR Part 429. ELGs in the plywood (Subpart C), wet storage (Subpart I), and sawmills and planing mills (Subpart K) subcategories are applicable to the PotlatchDeltic St. Maries Complex. EPA does not mandate the use of specific technologies; therefore, dischargers are free to use any available control technique to meet the limitations.

All receiving waters have ambient water quality standards that are established by the states, tribes, or EPA to maintain and protect designated uses of the receiving water (e.g., aquatic life, public water supply, primary contact recreation). The application of the technology-based effluent limits may result in pollutant discharges that exceed the water quality standards in particular receiving waters. In such cases, the CWA and federal guidelines require the development of more stringent WQBELs for the pollutant to ensure that the water quality standards are met. Additionally, pollutant parameters not limited in the wastewater treatment requirements may result in the development of WQBELs. EPA develops WQBELs in accordance with EPA guidance (USEPA, 1991).

The ESA regulations require the action agency to evaluate all interdependent actions (actions having no independent utility apart from EPA's Proposed Action) and interrelated actions (actions that are part of a larger action and depend on the larger action for their justification). The federal regulations at 50 CFR section 402.02 define an action as all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Because this is an existing facility that EPA is proposing to reauthorize a permitted discharge for, and there are no other Federal actions associated with this facility, EPA believes that there are no interdependent or interrelated actions connected to this action.

The Permit authorizes the discharge from existing Outfall 001 to the St. Joe River subject to effluent limitations, monitoring, and other conditions specified in the Permit. The Permit will be finalized following completion of this consultation. A copy of the draft Permit and the Fact Sheet for the draft Permit have been transmitted to USFWS along with the BE.

2.1 Permit Reissuance Status

The first NPDES permit for the PotlatchDeltic St. Maries Complex became effective on July 3, 1975. The most recent individual NPDES permit for this facility was issued October 1, 1996, became effective on October 31, 1996, and expired on October 31, 2001. An NPDES application for permit issuance was submitted by the permittee on May 10, 2001. EPA determined that the application was timely and complete. Therefore, pursuant to 40 CFR 122.6, the permit has been administratively continued and remains fully effective and enforceable.

The existing individual permit covers the discharge of log yard runoff comingled with non-contact cooling water, which flows to Outfall 001. Discharges of stormwater from Outfall 001 are currently covered under EPA's Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP), under permit number IDR05I310. The MSGP also covers stormwater discharges from three additional stormwater outfalls, which are numbered 002, 003, and 004.

Commented [SSP2]: Executive Summary states that the permit for Outfall 001 includes authorization of stormwater. Please clarify. Will this new NPDES supersede the MSGP authorization for this Outfall 001, as stormwater is comingled w/ log yard discharge? If so, then additional contaminants from stormwater (e.g., fuel, hydraulic oils, etc.) would need to be analyzed in this BA as well.

2.2 Facility Background

The facility encompasses 160 acres on the Coeur d'Alene Reservation and consists of a lumber mill, plywood plant, power plant, wet and dry log storage yards, and a woody debris storage area. A site map is provided in Figure 1.

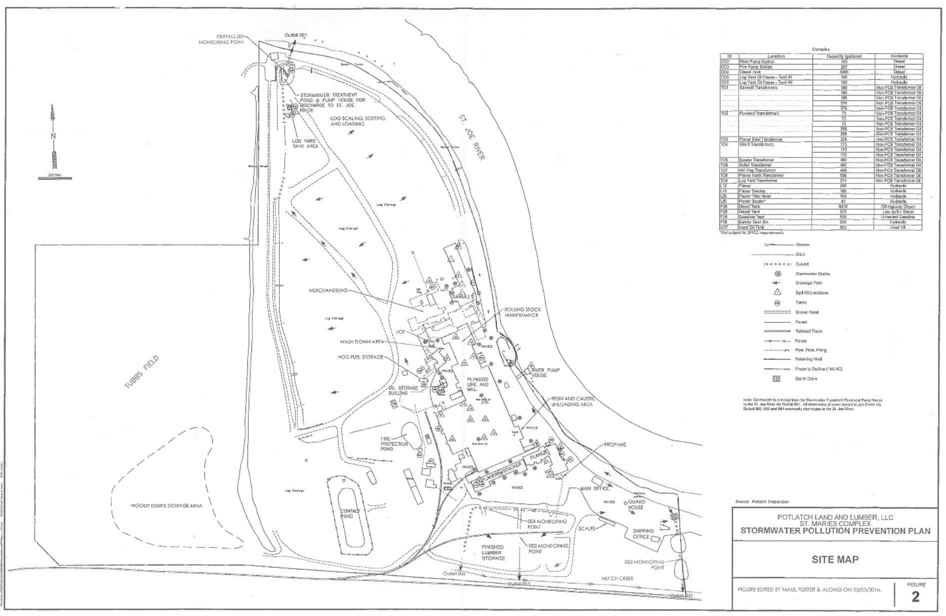

Figure 1: Site Map

The existing individual permit covers the discharge of log yard runoff comingled with non-contact cooling water, which flows to Outfall 001. Stormwater is commingled with the log yard runoff and cooling water prior to discharge from Outfall 001 and stormwater was disclosed as a waste stream in the application for reissuance of this individual permit.

Treatment for Outfall 001 consists of screening to remove floating debris and addition of a defoamer.

Potential pollutants in stormwater include fuel (gasoline and diesel), antifreeze, oils including hydraulic oil, bark and woody debris, phenolic resin, dust, and sediment. Control measures are in place to prevent or reduce discharges of these pollutants. The main pollutant of concern for non-contact cooling water is heat. Potential pollutants in log sprinkling runoff include woody debris.

For approximately seven months of the year, stormwater is re-used for log sprinkling.

2.3 Outfall Description

A drainage ditch channels flow to a stormwater treatment pond. A metal shipping container located above the pond serves as a pump house. The pump house contains a flow meter and defoamer, which is injected into the effluent before being pumped to Outfall 001.

Discharges from Outfall 001 reach the St. Joe River through a pipe from the pump house, which connects to the river via a short ditch (see Figure 2). Outfall 001 is located at latitude 47.329722 and longitude -116.590278, on the south bank of the St. Joe River.

Figure 2: Outfall 001

2.4 Permit Limits and Effluent Monitoring

As explained above, the draft permit contains both technology-based and water quality-based effluent limits. The technology-based effluent limits are based on ELGs in 40 CFR Part 429. Water quality-based effluent limits are based on Section 301(b)(1)(C) of the Clean Water Act and its implementing regulations (e.g., 40 CFR 122.44(d)).

To determine whether water quality based-limits for a particular discharge are needed, EPA follows guidance in its Technical Support Document for Water Quality-based Toxics Control (USEPA, 1991). EPA evaluated the Outfall 001 discharge to determine if "reasonable potential" exists. Water quality-based effluent limits were developed for those pollutants where there was "reasonable potential" to exceed the criteria established to protect the designated uses of the receiving water.

Effluent limits are not needed for those parameters that did not exhibit "reasonable potential." Monitoring was included in the Permit for those parameters where there was not enough data to determine the need for effluent limits. A detailed discussion of the reasonable potential evaluation is available in Section IV.E and Appendices C and D of the Fact Sheet for the Permit. The BE evaluates the potential for chemical and physical characteristics of the effluent to affect listed species.

Effluent limits and monitoring requirements in the draft permit are listed in Table 1.

Table 1: Effluent Limitations and Monitoring Requirements

Effluent Parameters	Units	Effluent Limitations		Monitoring Requirements	
		Monthly Average	Daily Maximum	Frequency	Sample Type
Flow	MGD	Report	Report	Weekly	Recording
Iron	mg/L	7.02	14.1	Monthly	Grab
	lb/day	64.4	129		Calculation[1]
pH	s.u.	6.5 to 8.5 std. units		Weekly	Grab
TSS	mg/L	75	165	Weekly	Grab
	lb/day	688	1,514		Calculation[1]
Zinc	µg/L	230	329	Monthly	Grab
	lb/day	2.1	3.0		Calculation[1]
2,4,5-Trichlorophenol	µg/L	—	Report	2/year[2]	Grab
2,4,6-Trichlorophenol	µg/L	—	Report	2/year[2]	Grab
2,4-Dichlorophenol	µg/L	—	Report	2/year[2]	Grab
2,4-Dimethylphenol	µg/L	—	Report	2/year[2]	Grab
2,4-Dinitrophenol	µg/L	—	Report	2/year[2]	Grab
2-Chlorophenol	µg/L	—	Report	2/year[2]	Grab
2-Methyl-4,6-Dinitrophenol	µg/L	—	Report	2/year[2]	Grab
3-Methyl-4-Chlorophenol	µg/L	—	Report	2/year[2]	Grab
Aluminum	µg/L	—	Report	2/year[2]	Grab
Ammonia, total as N	mg/L	—	Report	2/year[2]	Grab
COD	mg/L	—	Report	Quarterly[3]	Grab
Dinitrophenols	µg/L	—	Report	2/year[2]	Grab
Hardness	mg/L as CaCO3	—	Report	2/year[2]	Grab
Manganese	µg/L	—	Report	2/year[2]	Grab
Nitrate-Nitrite as N	mg/L	—	Report	2/year[2]	Grab
Nonylphenol	µg/L	—	Report	2/year[2]	Grab
Orthophosphate (as P)	mg/L	—	Report	2/year[2]	Grab
Pentachlorophenol	µg/L	—	Report	2/year[2]	Grab
Phenol	µg/L	—	Report	2/year[2]	Grab
Phosphorus, total as P	mg/L	—	Report	2/year[2]	Grab
Temperature	°C	Report	Report	Continuous	Recording
Total Kjeldahl Nitrogen	mg/L	—	Report	2/year[2]	Grab
Whole effluent toxicity	TUc	—	Report	2/year[2]	Grab

Effluent Parameters	Units	Effluent Limitations		Monitoring Requirements	
		Monthly Average	Daily Maximum	Frequency	Sample Type
Notes: 1. Loading (in lbs/day) is calculated by multiplying the concentration (in mg/L) by the corresponding flow (in mgd) for the day of sampling and a conversion factor of 8.34. For more information on calculating, averaging, and reporting loads and concentrations see the NPDES Self-Monitoring System User Guide (EPA 833-B-85-100, March 1985). 2. One sample must be taken between January 1st and June 30th and a second sample must be taken between July 1st and December 31st. Results must be reported on the June and December DMRs. 3. Quarters are defined as January 1st – March 31st, April 1st – June 30th, July 1st – September 30th, and October 1st – December 31st. Results must be reported on the March, June, September, and December DMRs.					

In developing WQBELs, the EPA converts criteria into limitations using the procedures in the TSD (USEPA, 1991). Factors that influence the development of effluent limits include effluent flow, receiving water critical low flows, effluent variability, and ambient water quality. Reasonable worst-case estimates of each of these factors were used to develop the effluent limits to ensure that they are protective of the aquatic organisms using the water quality criteria under critical conditions as a measure of the protectiveness. Each of these factors is discussed in detail in Appendices B and C of the Fact Sheet.

The receiving water body's ability to dilute effluent is also factored into the development of effluent limitations (40 CFR 122.44(d)(1)(ii)). Available dilution increases with distance downstream of the discharge point. The availability of dilution is termed a mixing zone. Under the Coeur d'Alene Tribe water quality standards, mixing zones may be authorized for discharges to meet water quality standards. Mixing zones are areas or volumes of receiving water where wastewater mixes with the receiving water and where water quality standards may be exceeded. Additional discussion of the mixing zones is provided in Section 3.1.3 of this BE.

The effluent limits are expressed in terms of concentration (e.g., mg/L) or in terms of mass (e.g., lbs/day) to ensure that the discharge to the receiving water complies with water quality standards and effluent guidelines. In general, effluent limitations must be expressed in terms of mass (40 CFR 122.45(f)). Mass-based limits are particularly important for control of bioconcentratable pollutants because concentration-based limits will not adequately control discharges of these pollutants if the effluent concentrations are below detection levels. However, mass-based limits alone may not assure attainment of water quality standards in waters with low dilution (i.e., less than 100-fold dilution) (USEPA, 1991). Therefore, some limits are expressed in both mass and concentration.

The federal regulations at 40 CFR 122.45(d) requires effluent limitations for continuous discharges to be expressed as maximum daily and average monthly limitations for all dischargers other than publicly owned treatment works (POTWs). 40 CFR Part 122.2 defines the maximum daily discharge as the highest allowable daily discharge and the average monthly discharge limitation as the highest allowable average of daily discharges over a calendar month (calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month). The regulation also defines daily discharge as the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for the purposes of sampling. For pollutants with limitations expressed in units of mass (e.g., lb/day), the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants expressed in other units of measurement (e.g., mg/L), the daily discharge is calculated as the average measurement of the pollutant over the day.

Section 304(h) of the Clean Water Act (CWA) requires the EPA Administrator to promulgate guidelines establishing test procedures for the analysis of pollutants. The EPA's approval of analytical methods is authorized under section 304(h) of the CWA, as well as the general rulemaking authority in section 501(a) of the Act. The EPA uses these test procedures to support the development of effluent limitations guidelines, to establish compliance with NPDES permits, for implementation of pretreatment standards, and for section 401 certifications. The section 304(h) test procedures (analytical methods) are specified in part 136 of title 40 of the Code of Federal Regulations (40 CFR Part 136). All methods specified in the permit are published in 40 CFR Part 136. These methods have been validated by the EPA, published in the federal register for public comment, approved by the EPA and incorporated, by rulemaking, into the Code of Federal Regulations.

The conditions and effluent limits in the Permit were developed using Coeur d'Alene Tribe (CDT) water quality standards (WQS), while also considering Idaho WQS at IDAPA 58.01.02 in order to protect downstream uses. For constituents without numeric water quality criteria in the CDT or Idaho WQS, EPA used EPA's water quality criteria, published under section 304(a) of the CWA.

As such, new and/or modified effluent limitations and monitoring requirements are found in the Permit that will specifically assure that CDT WQS designated uses are met, as well as Idaho's designated uses for downstream waters. Changes in limits and conditions in reissued NPDES permits may also stem from changes to pollutant effluent concentrations/loadings and changes in the receiving water. All effluent limits in the Permit are at least as stringent as those in the current permit. Region 10 used the most-current, available effluent and receiving water data when developing the Permit.

3 Action Area

For the analysis of the potential effects of the EPA's Proposed Action on listed species, a project action area is identified. Pollutants in an effluent may affect the aquatic environment near the point of discharge (near-field) or at a considerable distance from the point of discharge (far-field). The ESA implementing regulations define action area as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR section 402.02). "Effects of the action" are defined as "all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action" (84 FR 45016).

Since EPA's Proposed Action is the re-issuance of the NPDES permit, the direct effects are those that would cause toxicity to a listed species from individual and combined pollutant concentrations within the hydrodynamic mixing zone. The presence of parameters regulated by the Permit could potentially be present at a concentration that could cause toxicity to a listed species at different distances downstream from the discharge, depending upon the effluent limit, available dilution from the river, and the physical and chemical characteristics of the parameter.

The area where direct effects may occur commences at the point of discharge. Therefore, the action area is bounded on the upper end at Outfall 001. The action area downstream for a specific parameter depends on the physical and chemical properties that cause it to degrade or dilute as it travels downstream. A parameter that is highly volatile or readily biodegradable in a river may be present over a relatively small downstream area at a concentration that could potentially cause toxicity, because several mechanisms effectively remove the parameter from the river. On the other hand, a parameter that is persistent in the environment and is not readily biodegraded in a river system might be present over a longer downstream distance at a concentration that could potentially cause toxicity, because removal mechanisms are less effective in eliminating this parameter from the river.

Indirect effects for the EPA's Proposed Action are those that would cause an effect to a listed species or habitat from individual and/or combined pollutant concentrations within the waterbody at a later time. These effects would result from delayed exposure (e.g., uptake of deposited effluent constituents from sediment resuspension, consumption of prey species, and habitat modification (e.g., deposited effluent constituents on the riverbed, decrease in photosynthesis). Any of these indirect effects could occur as long as there is influence on the receiving water column and sediment quality from the discharge. Therefore, the indirect action area extends to the point downstream where an indirect adverse effect could occur (e.g., where the concentration of a parameter in the sediment resulting from the effluent discharge is high enough to cause an adverse effect to threatened and endangered fish species).

For the analysis conducted in this BE, the action area includes waters in the St. Joe River downstream of the outfall that may be impacted by the discharge. This area encompasses the chronic and acute mixing zones and the downstream area prior to the zone where complete mixing is predicted to occur.

Commented [SSP3]: Can the mixing zone be more discretely defined and/or visually presented? How far downstream could the mixing zone be based on maximum possible input and river flow? Is it expected to occur across the entire width of the river? That is, will bull trout be able to bypass the action area or will they be obligated to pass through the mixing zone?

3.1 Water Quality Standards

Section 303(c) of the Clean Water Act requires every State to develop water quality standards applicable to all water bodies or segments of water bodies that lie within the State. A water quality standard defines the water quality goals of a water body, or a portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by establishing antidegradation policies and implementation procedures that serve to maintain and protect water quality. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. A water quality standard should (1) include provisions for restoring and maintaining chemical, physical, and biological integrity of State waters; (2) provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water; and (3) consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation.

EPA has established water quality standards regulations at 40 CFR Part 131. Under section 510 of the Clean Water Act, States may develop water quality standards more stringent than required by this regulation. Water quality standards are composed of three parts: use classifications, numeric and/or narrative water quality criteria, and an antidegradation policy. The use designations required under the Clean Water Act include public water supply, recreation, and propagation of fish and wildlife. The States are free to designate more specific uses (e.g., cold water aquatic life, agricultural), or to designate uses not mentioned in the CWA, except for waste transport and assimilation which is not an acceptable designated use. Section 303(a-c) of the Clean Water Act requires States to adopt criteria adequate to protect designated uses for State waters. These criteria may be numeric or narrative.

Water quality criteria set ambient levels of individual pollutants or parameters or describe conditions of a waterbody that, if met, will generally protect the designated use of the water. Water quality criteria are developed to protect aquatic life and human health, and, in some cases, wildlife from the deleterious effects of pollutants. Section 304(a) of the Clean Water Act directs EPA to publish water quality criteria guidance to assist States in developing water quality standards. EPA criteria consist of three components: magnitude (the level of pollutant that is allowable, generally expressed as a concentration), duration (the period of time over which the instream concentration is averaged for comparison with criteria concentrations), and frequency (how often criteria can be exceeded). Currently, EPA has developed criteria for approximately 150 pollutants.[2] EPA criteria for the protection of aquatic life address both short-term (acute) and long-term (chronic) effects on freshwater species while human health criteria are designed to protect people from exposure resulting from consumption of water and fish or other aquatic life.

The federal regulations at 40 CFR 131.12 require States to adopt an antidegradation policy and implementation methods that provide three tiers of protection from degradation of water quality. Tier 1 protects existing uses and provides the absolute floor of water quality for all waters of the United States. Tier 2 protects the level of water quality necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water in waters that are currently of higher quality than required to support these uses. Tier 3 protects the quality of outstanding national resources, such as waters of national and State parks and wildlife refuges, and waters of exceptional recreational or ecological significance.

[2] https://www.epa.gov/wqc/national-recommended-water-quality-criteria

Once standards are developed and adopted by States, EPA must review and approve or disapprove them. EPA's review is to ensure that the State water quality standards meet the requirements of the CWA and the water quality standards regulation. EPA may promulgate a new or revised standard for a State where necessary to meet the requirements of the CWA. Currently, States are required to review their water quality standards at least once every three years and revise them as necessary. The most current State water quality standards are used for the development of permit limitations.

The Coeur d'Alene Tribe received treatment in a manner similar to a state (TAS) status for administering water quality standards (WQS) over portions of Lake Coeur d'Alene and the St. Joe River that lie within the boundaries of the Coeur d'Alene Reservation. These waters are referred to as "Reservation TAS Waters." Water Quality Standards for Approved Surface Waters of the Coeur d'Alene Tribe are in effect for CWA purposes, effective June 12, 2014. This is the first instance of an NPDES permit reissuance where CDT WQS are in effect for CWA purposes. Permit conditions and effluent limits in the previously issued (1996) permit relied on Idaho WQS. The EPA used the CDT WQS in determining whether water quality-based effluent limits were needed and in developing Permit conditions and effluent limitations. The EPA also considered/referenced ID WQS at IDAPA 58.01.02 to ensure that the Permit conditions protect downstream uses, including cases where CDT WQS are not in effect for Clean Water Act Purposes.

The CDT has adopted general water use classifications that apply to all Reservation TAS Waters. All TAS Waters shall be designated for the uses of industrial water supply, aesthetics, and wildlife habitat. Additionally, TAS Waters are classified for:

- Domestic Water Supply
- Agricultural Water Supply
- Recreational and Cultural Use
- Bull Trout and Cutthroat Trout

3.1.1 Numeric Water Quality Criteria

Table 3 provides the numeric water quality criteria that apply to the St. Joe River for these uses.

Pollutant of Concern[1]	Acute	Chronic	Human Health, Water + Organism	Human Health Organism Only	Agricultural Water Supply	Water Quality Standard Used/Referenced
Aluminum (µg/L)	280	150	—	—	—	EPA 304(a)
Ammonia (µg/L)	13,283	2,559	—	—	—	ID[2]
Barium (µg/L)	—	—	1000	—	—	EPA 304(a)
Boron (µg/L)	—	—	—	—	750	EPA 304(a)
Iron	—	1000	—	—	—	EPA 304(a)
Manganese	—	—	50	100	—	EPA 304(a)
pH (s.u.)	Within the range of 6.5 – 8.5		—	—	—	CDT
Temperature (°C)	22	19	—	—	—	ID

Pollutant of Concern[1]	Acute	Chronic	Human Health, Water + Organism	Human Health Organism Only	Agricultural Water Supply	Water Quality Standard Used/Referenced
Temperature (°C), June - September within hypolimnion	16	—	—	—	—	CDT
Dissolved Oxygen (mg/L)	8.0 (minimum)	—	—	—	—	CDT
Total Suspended Solids (mg/L)	—	—	—	—	75	CDT
Zinc (µg/L)	20.3	20.4	870[4]	1,500[4]	—	CDT/ID

1. Pollutants of concern for which reasonable potential analysis was conducted.
2. The EPA disapproved the CDT WQS for ammonia. Therefore, ID WQS were referenced.
3. Translated from narrative CDT WQS using recommended criteria in EPA's 1991 Technical Support Document for Water Quality-based Toxics Control (TSD) as reference.
4. The EPA did not act on CDT human health criteria. Therefore, ID WQS were referenced.
5. The draft permit requires monitoring to generate data to be entered into the copper BLM model to calculate site-specific aquatic life criteria for copper and conduct reasonable potential in future permitting actions.
6. The EPA disapproved CDT WQS aquatic life criteria for copper and did not act on human health criteria. Therefore, ID WQS for human health were referenced.

3.1.2 Narrative Water Quality Criteria

Narrative criteria are statements that describe the desired water quality goal and supplement the numeric criteria. Narrative criteria can be the basis for limiting specific pollutants where the State has no numeric criteria for those pollutants or they can be used to limit toxicity where the toxicity cannot be traced to a specific pollutant (e.g., whole effluent toxicity). Narrative criteria may be translated into numeric criteria, as appropriate. The following narrative criteria from the Coeur d'Alene Tribe water quality standards were considered in development of the Permit.

Nutrients or other substances from anthropogenic causes shall not be present in concentrations which will produce objectionable algal densities or nuisance aquatic vegetation, result in a dominance of nuisance species, or otherwise cause nuisance conditions.

- Turbidity shall not be at a level to impair designated uses or aquatic biota.
- Toxic substances shall not be introduced into Reservation TAS Waters in concentrations which have the potential either singularly or cumulatively to adversely affect existing and designated water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the Department, except as allowed for under Mixing Zones.
- Floating Solids, Oil and Grease. All waters shall be free from visible oils, scum, foam, grease, and other floating materials and suspended substances of a persistent nature resulting from anthropogenic causes.
- Color. True color-producing materials resulting from anthropogenic causes shall not create an aesthetically undesirable condition; nor should color inhibit photosynthesis or otherwise impair the existing and designated uses of the water.

3.1.3 Mixing Zones

A mixing zone is a limited area or volume of water where initial dilution of a discharge takes place and within which certain water quality criteria may be exceeded. While the criteria may be exceeded within the mixing zone, the use and size of the mixing zone must be limited such that the waterbody as a whole will not be impaired, all designated uses are maintained, and acutely toxic conditions are prevented. Mixing zone policies are established in Section 3(1) of the CDT WQS, which state: All Reservation TAS Waters shall be free from pollutants in concentrations or combinations that do not protect the most sensitive use of the water body, except as provided for under Mixing Zones (section 12). Mixing zones may vary from pollutant to pollutant, and multiple water quality criteria may apply to a single pollutant. For example, in the case of zinc, the following criteria apply: chronic aquatic life; acute aquatic life; human health water and organism; and human health organism only. All were used/considered in development of the Permit. Section 12(2) of the CDT WQS specifies which low flow statistic (e.g., 7Q10, harmonic mean) is to be used in water quality-based effluent limitation calculations depending on the specific water quality criteria class. For example, chronic aquatic life criteria utilize the 7Q10 flow. In this case, a 25 percent mixing zone would represent 25 percent of the 7Q10 river flow in cfs. Section 12(1)(c) of the CDT WQS establishes that the allowable size, shape, and location of a mixing zone is established in certifications under Section 401 of the CWA.

Mixing zones were used to calculate the proposed effluent limits for the following parameters:

- Iron
- Zinc

Mixing zones were also used to conduct reasonable potential analyses for parameters for which effluent limitations were not developed (i.e., reasonable potential was not found when applying a mixing zone). However, effluent monitoring requirements are proposed for such parameters. The EPA also calculated dilution factors for critical low river flow conditions. All dilution factors are calculated with the effluent flow rate set equal to the maximum of 1.1 mgd. If the CDT revises the allowable mixing zone in its final certification of the Permit, reasonable potential analysis and water quality-based effluent limit calculations will be revised accordingly. Table 4 presents critical low flow statistics, mixing zones, and dilution factors associated with respective criteria that were used in Permit development.

Table 2: Mixing Zones

Criteria Type	Critical Low Flow (cfs)	Mixing Zone (% of Critical Low Flow)	Dilution Factor
Acute Aquatic Life (1Q10)	125	25%	19.4
Chronic Aquatic Life (except ammonia) (7Q10)	258	25%	38.9
Chronic Aquatic Life (ammonia) (30B3)	408	25%	60.9
Human Health Noncarcinogen (30Q5)	363	25%	54.3
Human Health Carcinogen	1076	25%	159.1

3.1.4 Water Quality Assessment

Idaho's 2016 305(b) Integrated Report identifies the 3.76 mile stretch of the St. Joe River receiving the discharge as Category 3 or lacking sufficient data to determine if any beneficial uses are being met (i.e., unassessed). The St. Joe River downstream, between the point of discharge and Coeur d'Alene Lake, is also unassessed by IDEQ, ostensibly because it is waters of the Coeur d'Alene Tribe. See Figure 4 below.

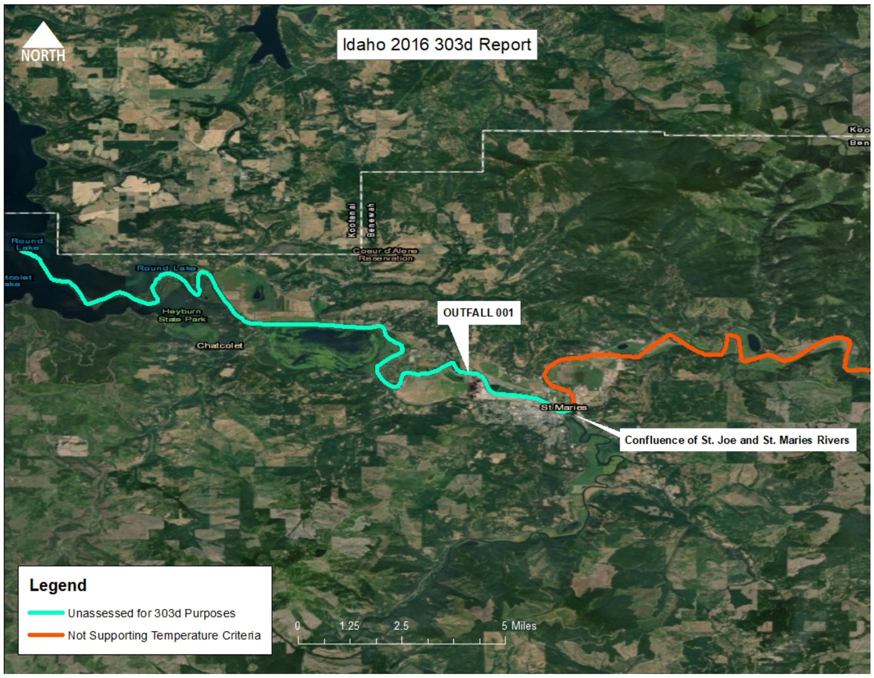

Figure 3: Beneficial use support status

Upstream of the discharge, the lower St. Joe River (ID17010304PN027_05) from the North Fork St. Joe River to the confluence with the St. Maries River was identified as exceeding Idaho water quality temperature criteria and was listed as Category 5 (not supporting) in Idaho's Integrated Report in 2002 (IDEQ, 2011). An EPA-approved TMDL (Category 4a) for temperature is in effect on the St. Joe (ID17010304PN027_05) approximately 1.5 river miles upstream of the discharge, which is not meeting ID cold water aquatic life uses, as well as an EPA-approved TMDL for temperature and sediment on the St. Maries approximately 1.5 miles upstream of the discharge where the St. Joe and St. Maries Rivers join (ID17010304PN007_05), which is also not supporting cold water aquatic life uses. Coeur d'Alene Lake, approximately eight river miles downstream of the discharge, is not supporting (Category 5) cold water aquatic life criteria due to cadmium, lead, and zinc exceedances of water quality standards, though a TMDL has not been approved by the EPA. In 2009, The CDT and IDEQ collaboratively developed the 2009 Lake Management Plan with the goal "to protect and improve lake water quality by limiting basin-wide nutrient inputs that impair lake water quality conditions, which in turn influence the solubility of mining-related metals contamination contained in lake sediments" (IDEQ&CdAT, 2009). The Plan does not establish numeric nutrient criteria.

4 Status of Species and Critical Habitat

4.1 Species Descriptions

This section describes the threatened and endangered species that may occur in the action area as indicated by the USFWS Information for Planning and Consultation and the NOAA The NOAA Fisheries Protected Resource App. The discussion includes the life history, habitat use, and habitat concerns as well as specific information on the abundance and timing of occurrence of each species within the action area. The species addressed in this section and their status is listed in Table 3.

Table 3: ESA-listed Species and Critical Habitat in the Action Area

Listing Type	Specie(s)
Endangered	None
Threatened	Bull Trout, *Salvelinus confluentus*
Proposed Threatened	North American Wolverine, *Gulo gulo luscus*
Critical Habitat	Bull Trout, *Salvelinus confluentus*
Proposed Critical Habitat	None

4.1.1 Bull Trout (Salvelinus confluentus)

4.1.1.1 Status and Distribution

All bull trout in the conterminous U.S. were listed as threatened November 1, 1999 (64 FR 58910). The listing consolidated listings for multiple distinct population segments including the Coastal-Puget Sound populations (Olympic Peninsula and Puget Sound regions), Saint Mary-Belly River populations (east of the Continental divide in Montana), and three separate distinct population segments of bull trout in the Columbia River, Klamath River, and Jarbidge River basins. The range of the bull trout includes Washington, Oregon, Idaho, Nevada, Montana, and western Canada. See Figure 5. Although once abundant throughout these regions, the distribution of populations has declined significantly (75 FR 63897). Population declines are largely attributed to habitat degradation, population isolation, and nonnative species invasions (USFWS, 2014).

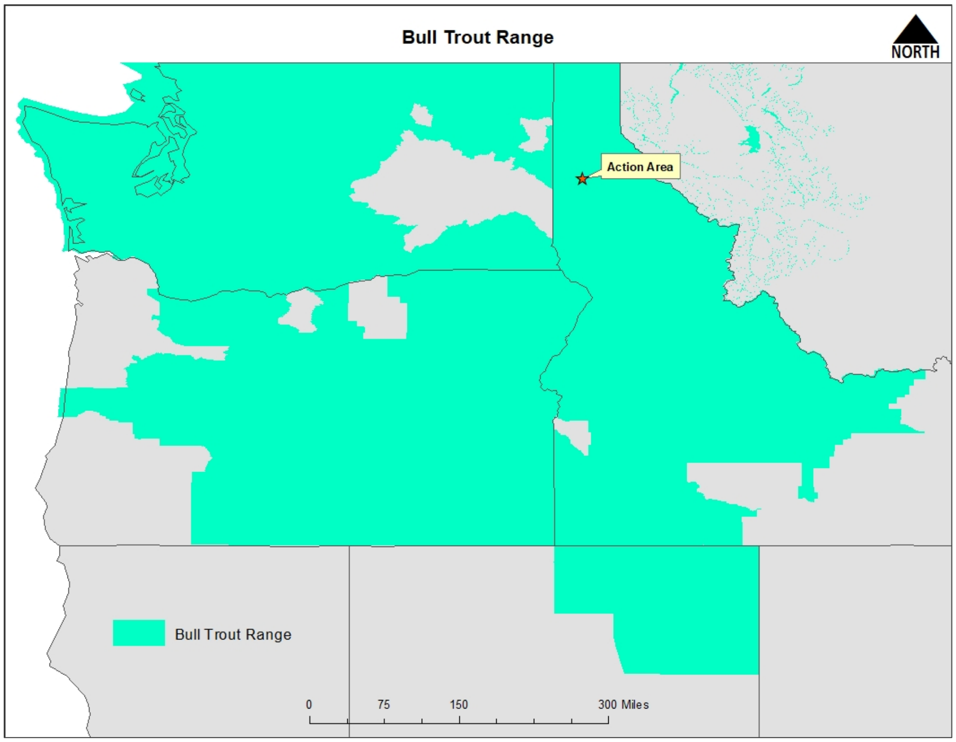

Figure 4: Bull Trout Range

4.1.1.2 Life History and Ecology

Bull trout are native to the Pacific Northwest and western Canada and are widespread throughout the tributaries of the Columbia River Basin (63 FR 31647). In Idaho, bull trout exhibit both resident and migratory life history strategies (BPA, USBR, & USACE, 1999). Resident bull trout complete their entire life cycle in or near tributary streams where they spawn and rear (Bruce E. Rieman & McIntyre, 1993). Migratory bull trout spawn in tributary streams where juvenile fish rear for one to three years before migrating to a lake (adfluvial life history forms) or river (fluvial life history forms) (Dunham & Rieman, 1999; Goetz, 1989). Resident and migratory forms may be found together, and either form may produce offspring exhibiting either resident or migratory behavior (Bruce E. Rieman & McIntyre, 1993).

Bull trout reach sexual maturity in four to seven years and may live longer than 12 years. They are iteroparous, meaning that they may spawn more than once in a lifetime. Adult bull trout migrate from feeding to spawning grounds during the spring and summer (64 FR 58910). Spawning typically occurs from August through November, during periods of increasing flows and decreasing water temperatures, and peaks during September and October (Batt, 1996). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt, 1992; Bruce E. Rieman, Lee, & Thurow, 1997; Bruce E. Rieman & McIntyre, 1993) that exhibit high water quality with loose, clean gravel and cobble substrate (BPA et al., 1999). In fact, water temperatures of 10 °C or less typically induce spawning (Batt, 1996) (64 FR 58910). Spawning sites are typically found in runs, tails and pools with water depth ranging from 0.2 to 0.8 m.

Eggs are buried 10 to 20 cm in the gravel with a water velocity ranging from 0.2 to 0.6 m/s (Batt, 1996). Bull trout embryos incubate over the winter and hatch in late winter or early spring (Weaver & White, 1985). The relatively long incubation period makes bull trout eggs and embryos vulnerable to fine sediment accumulation and water quality degradation (Fraley & Shepard, 1989). Fry normally emerge from early April through May, depending on water temperatures and increasing stream flows (Howell & Buchanan, 1992; Pratt, 1992; Bruce E. Rieman & McIntyre, 1993).

While all bull trout are sensitive to temperature and Bruce E. Rieman and McIntyre (1993) report that temperatures greater than 15 °C limit bull trout distribution, juvenile bull trout are more sensitive to temperature changes than other life stages. Hillman and Essig (1998) found that the optimal temperature for juvenile growth and rearing is likely 12° to 14 ° C. Juvenile bull trout prey on terrestrial and aquatic insects but become piscivorous as they mature (USFWS, 1998). They migrate during the spring, summer and fall. Once reaching the river mainstem or lake, they will remain there until sexual maturity, which is from four to seven years of age (USFWS, 1998). Migratory bull trout are typically larger than the resident forms due to the increased productivity of larger streams and lakes, reaching lengths of 24 inches. Resident fish are commonly six to twelve inches as adults (63 FR 31647).

Bull trout have more specific habitat requirements than most other salmonids (Bruce E. Rieman & McIntyre, 1993). Habitat components that influence bull trout distribution and abundance include water temperature (as described above), availability of cover, channel form and stability, valley form, spawning and rearing substrate, and migratory corridors (Goetz, 1989; Howell & Buchanan, 1992; Pratt, 1992; Bruce E. Rieman & McIntyre, 1993, 1995; Sedell & Everest, 1991; Watson & Hillman, 1997). All life history stages of bull trout are associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Goetz, 1989; Hoelscher & Bjornn, 1989; Sedell & Everest, 1991; Watson & Hillman, 1997). Early life stages of bull trout, specifically the developing embryo, require the highest inter-gravel dissolved oxygen levels, and are the most sensitive life stage to reduced oxygen levels. The oxygen demand of embryos depends on temperature and stage of development, with the greatest dissolved oxygen required just prior to hatching.

Bull trout are opportunistic feeders, with food habits primarily a function of size and life-history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, and small fish (Donald & Alger, 1993; Goetz, 1989). Bull trout may also feed heavily on fish eggs of other salmon (Lowery & Beauchamp, 2015). Subadult and adult migratory bull trout feed on various fish species (Donald & Alger, 1993).

4.1.1.3 Habitat Concerns and Recovery

Primary threats to the bull trout within the CHRU include habitat degradation, demographics (low population sizes and isolation), and competition and predation from nonnative fishes. Elevated temperatures and low dissolved oxygen levels within the St. Joe River impact bull trout foraging, migration, and overwintering possibilities. Small population size and lack of replication of stable populations limit recovery potential in the St. Joe River. In addition to direct predation threats, nonnative fishes - including northern pike, smallmouth bass, and possibly Chinook salmon - also threaten juvenile and subadult migration potential (USFWS, 2015b).

The CHRU Implementation Plan for Bull Trout identifies several recovery tasks to address primary threats to bull trout habitat and demographics in the Coeur d'Alene Geographic Region, Coeur d'Alene Lake Core Area (Complex), however only the following relate to EPA's Proposed Action:

- To address habitat threats:
  - Identify, and mitigate to the extent possible, sources of water temperature increase in Coeur d'Alene and St. Joe Rivers.
  - Improve water quality in tributaries to Coeur d'Alene Lake, by reducing stream temperature and pollutants, with focus to improving low DO levels in feeding, migration, and overwintering (FMO) habitats.
- To address demographic threats, incorporate survey data into Coeur d'Alene Lake core area threats assessment.

4.1.1.4 Occurrence in the Action Area

Limited population data/information is available at a fine-enough scale to accurately predict bull trout occurrence in the immediate action area. In order to estimate the probability of occurrence, the best-available information and data from the following sources was assessed, which can also inform discussions of far field and/or cumulative impacts to individuals and critical habitat:

- Recovery Plan (USFWS, 2015b)
- Coeur d'Alene Tribe Fish and Wildlife Program Habitat Protection Plan: Implementation of Fisheries Enhancement Opportunities on the Coeur d'Alene Reservation, 1997-2002 Technical Report (Vitale, Roberts, & Peters, 2002).
- Distribution, Abundance, and Population Trends of Bull Trout in Idaho (High, Meyer, Schill, & Mamer, 2008)
- Columbia Headwaters Recovery Unit Implementation Plan for Bull Trout (USFWS, 2015a);
- Climate Shield Cold-Water Refuge Streams for Native Trout (Isaak et al., 2017);
- The Rangewide Bull Trout eDNA Project (Young et al., 2017);
- Coeur d'Alene Basin Restoration Plan and Environmental Impact Statement (USDA, 2018)

Within the CHRU defined by USFWS in the Implementation (IP) Plan for Bull Trout, the action area falls within Core Area 4, Coeur d'Alene Lake (USFWS, 2015a). The IP notes that bull trout are present (though in potentially low numbers and in patchy distributions) in most watersheds within the CHRU where they have historically occurred, with 5 suspected local populations within the Core Area.

According to the Coeur d'Alene Tribe Fish and Wildlife Program Habitat Protection Plan, "A quantifiable number or density describing a healthy bull trout population is currently unavailable and likely to be unique within each watershed, however it is certain that current populations are severely depressed" (Vitale et al., 2002) and scientists with IDFG stated that "…data available from the Clark Fork River, Kootenai River, and Coeur d'Alene River recovery units were limited, making it difficult to draw any conclusions about bull trout abundance in these areas" (High et al., 2008).

The Range-Wide Bull Trout eDNA Project used the results of the Climate Shield model to inform sampling programs to collect environmental DNA (eDNA) from streams and rivers in efforts to determine whether bull trout were present in those waterbodies. In 2015, The Range-Wide Bull Trout eDNA Project paired predictions of bull trout habitat occupancy from the Climate Shield model with an optimized eDNA protocol to survey all juvenile bull trout habitats throughout 8-digit HUC river basins located within the species' historical range. Figure 3 depicts the presence/absence of bull trout in three watersheds surrounding the action area (the Upper Coeur d'Alene River Basin HUC 17010301, the South Fork Coeur d'Alene River Basin HUC 17010302, and the St. Joe River Basin HUC 17010304). Bull trout were found to be present in the upper St. Joe River watershed (Young et al., 2017). However, there does not appear to be any survey data available for the St. Joe River near the action area (within the red circle in Figure 5 below.

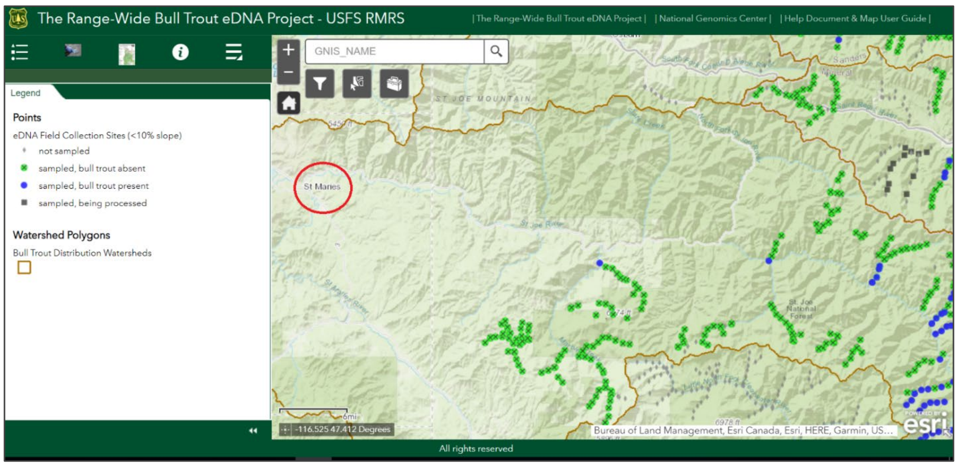

Figure 5: Range-Wide Bull Trout eDNA Project Sampling Locations and Results (Young et al., 2017)

It is clear that bull trout are present in the upper St. Joe river watershed, which is outside of the action area, and that this population may migrate to Coeur d'Alene lake for feeding and overwintering, see USFWS (2009) at Page 482, thereby navigating the St. Joe River within the action area. Further, the IDEQ St. Joe Subbasin Temperature TMDL Addendum notes that the lower St. Joe River (which includes the action area) "although designated for salmonid spawning, is not consistent with salmonid spawning habitat. However, this section of the river is used by native cutthroat and bull trout as a migratory route to tributaries and streams that are used for spawning," see IDEQ (2011) at Page 17). Based on this review, it appears that there may be a limited presence of migrating bull trout in receiving waters within the action area.

4.1.1.5 Critical Habitat

On October 10, 2010, USFWS revised the designation of critical habitat for bull trout in the coterminous U.S. and established 32 critical habitat units (CHUs) in 6 recovery units (RUs) (75 FR 63898). Critical habitat for bull trout includes approximately 32,187 km (20,000 miles) of riverine habitat, 1,207 km (750 miles) of marine shoreline, and 197,487 ha (488,001 acres) of lacustrine habitat. Critical habitat spans Washington, Oregon, Idaho, Nevada, and Montana (Figure 7).

The action area contains designated critical habitat within the Coeur d'Alene River Basin Unit [CHU 29]. The Coeur d'Alene River Basin Unit is part of the Columbia Headwaters Recovery Unit (CHRU), which is one of six biologically based bull trout Recovery Units established by FWS in the coterminous United States.

The Coeur d'Alene River Basin Unit encompasses the Kootenai, Shoshone, Benewah, Bonner, and Latah Counties in Idaho, including the entire Coeur d'Alene Lake basin in northern Idaho. The major drainages in the CHRU include the Coeur d'Alene Lake Basin, Kootenai River Basin, and the Clark Fork River Basin. This CHU includes approximately 510.5 miles of streams and 31,152.1 acres of lake surface area as designated critical habitat. There are no subunits in the Coeur d'Alene River Basin CHU. The Coeur d'Alene River Basin CHU provides bull trout spawning, rearing, foraging, migratory, connecting, and overwintering habitat (75 FR 63897).

Based on the large and diverse landscape of the CHRU, USFWS has separated the 35 core areas into five natural geographic assemblages; one of these natural geographic areas is the Coeur d'Alene Geographic Region, which is most relevant to the Action described in this BE.

According to the 2015 CHRU Implementation Plan, the Coeur d'Alene Geographic Region consists of a single, large complex core area centered on Coeur d'Alene Lake. USFWS explains that the Coeur d'Alene Geographic Region "is grouped into the CHRU for purposes of physical and ecological similarity..." (i.e., the bull trout's life history pattern of spawning and rearing in tributary streams and migrating to lakes or reservoirs to mature, otherwise known as adfluvial bull trout life history, and nonanadromous linkage), "…rather than due to watershed connectivity with the rest of the CHRU, as it flows into the mid-Columbia River far downstream of the Clark Fork and Kootenai systems."

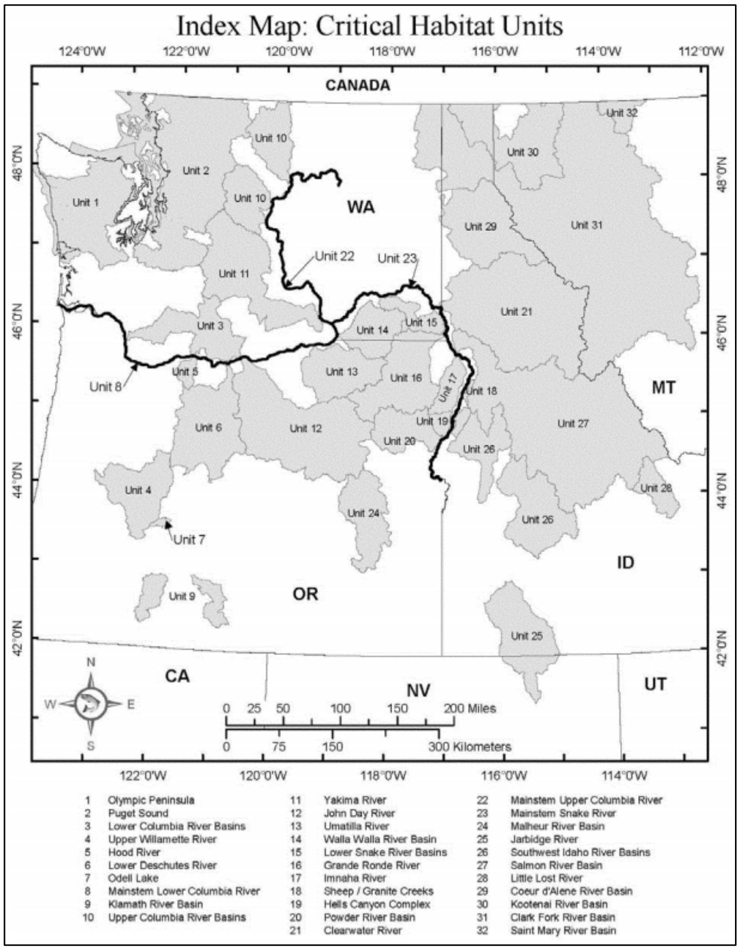

Figure 6: Critical Habitat Units for Bull Trout of the Coterminous US (Source: 75 FR 63898)

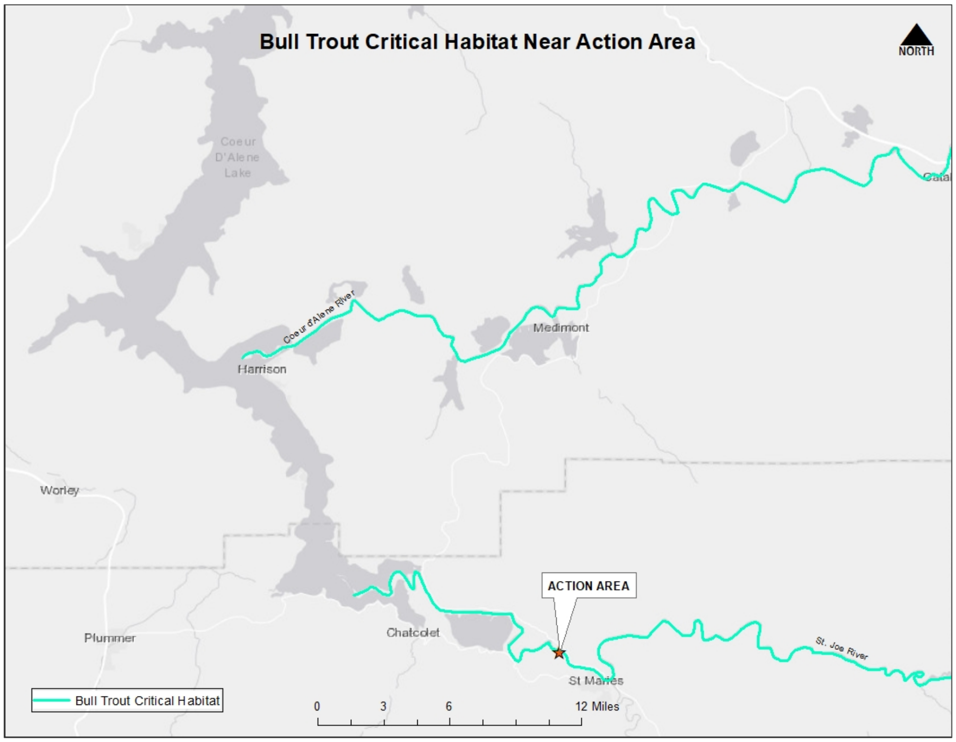

Figure 7: Bull Trout Critical Habitat near Action Area

The physical and biological features (PBFs) determined to be essential to the conservation of bull trout are:

- Springs, seeps, groundwater sources, and subsurface water connectivity (hyporheic flows) to contribute to water quality and quantity and provide thermal refugia;
- Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers;
- An abundance of food, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish;
- Complex shorelines with features such as large wood, side channels, pools, undercut banks, and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure;
- Water temperatures ranging from 2 to 15°C (36 to 59°F), with adequate thermal refugia available for temperatures that exceed the upper end of this range;
- Sufficient and appropriate substrate in spawning and rearing areas;
- Water flows approximating natural timing (historic and seasonal ranges) for peak, high, low, and base flow;

- Sufficient water quality and quantity to sustain normal reproduction, growth, and survival; and
- Low occurrence of nonnative predatory (e.g., lake trout, walleye, northern pike, smallmouth bass), interbreeding (e.g., brook trout), or competing (e.g., brown trout) species.

4.1.1.6 Essential Fish Habitat in the Action Area

Essential fish habitat (EFH) is the waters and substrate (sediments, etc.) necessary for fish to spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act (January 21, 1999) requires the EPA to consult with NOAA Fisheries when a proposed discharge has the potential to adversely affect EFH (i.e., reduce quality and/or quantity of EFH). A review of the action area in NOAA's Essential Fish Habitat Mapper showed no EFH in the action area.

The EFH regulations define an adverse effect as any impact which reduces quality and/or quantity of EFH and may include direct (e.g. contamination or physical disruption), indirect (e.g. loss of prey, reduction in species' fecundity), site specific, or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. Because there is no EFH in the action area, the EPA has determined that EPA's Proposed Action will not adversely affect EFH.

Commented [SSP4]: This section can be removed as it does not pertain to USFWS trust species

4.1.2 North American Wolverine (Gulo gulo luscus)

The USFWS has proposed to list the North American wolverine (Gulo gulo luscus) as threatened under the ESA. The most recent proposed rule and re-opening of the public comment period occurred in October 2016 (81 FR 71670).

4.1.2.1 Life History and Ecology

The historical range of the North American wolverine includes Colorado, Idaho, Minnesota, Montana, Nevada, North Dakota, Utah, and Wyoming (USFWS, 2011). Generally, this species selects habitat that is cold and maintains deep persistent snow through the winter and lasting late into the warmer seasons. In North America, particularly in the southern portion of the species' range where ambient temperatures may be the warmest, the wolverine distribution is restricted to the high-elevation alpine regions of Washington, Idaho, Montana, Wyoming, California, and Colorado. However, wolverines can occur within a wide variety of alpine, boreal, and arctic habitats, including boreal forests, tundra, and western mountains. Wolverines tend to live in remote and inhospitable places away from human populations and they are seldom encountered, documented, or studied.

Wolverines have large spatial requirements; the availability and distribution of food is likely the primary factor in determining wolverine movements and home range (Banci, 1994; Hornocker & Hash, 1981). Wolverines can travel long distances over rough terrain and deep snow, with adult males generally covering greater distances than females (Banci, 1994; Hornocker & Hash, 1981).

Wolverines are opportunistic feeders, consuming a variety of foods depending on availability. They primarily scavenge carrion, but also prey on small animals and birds and eat fruits, berries, and insects (Banci, 1994; Hash, 1987; Hornocker & Hash, 1981; Wilson, 1982).

4.1.2.2 Occurrence within the Action Area

Based on the distribution and movement patterns of the North American wolverine, it is not likely that this species would be present within the action area because of the higher human population densities and lack of snow. Therefore, the EPA has determined that the EPA's Proposed Action will have no effect on the wolverine, and it will not be discussed further in this analysis.

Commented [SSP5]: Add: and therefore will not jeopardize the continued existence of the N.A. wolverine.

5 Environmental Baseline

Regulations implementing the ESA (50 CFR 402.02) define the environmental baseline as the past and ongoing impacts of all Federal, State or private actions and other human activities leading to the current status of a species, its habitat, and ecosystem within the action area. Also included in the environmental baseline are the anticipated impacts of all proposed Federal projects in the action area that have undergone previous ESA Section 7 consultation, and the impacts of state and private actions which are contemporaneous with this consultation. The environmental baseline may not be known for all parameters of concern because they either have not been measured in the action area or they were not detected in the action area.

5.1 Ecoregional Setting

The EPA's Proposed Action is located in St. Maries, ID, which is located approximately eight St. Joe River miles upstream of Lake Coeur D'Alene. The point of discharge is within the Level IV Ecoregion – Northern Idaho Hills and Low Relief Mountains (15v), near the border of the Coeur d'Alene Metasedimentary Zone (15o) and St. Joe Schist-Gneiss Zone (15p) ecoregions. The ecoregion geology is characterized by quarternary volcanic ash, loess, and alluvium in river valleys. Productive cedar-hemlock-pine forests in the region are widely logged. Other uses include crop and pastureland, small grain and hay farming, grazing, wildlife habitat, and recreation. Temperature/moisture regimes include Frigid-Mesic/Xeric and Udic. Mean annual precipitation is 22 - 24 inches. Mean annual frost-free days are 50 – 130. Mean min and max temperatures in January are 23 and 35 °F respectively, and 50 and 86 °F in July, respectively (McGrath et al., 2002).

5.2 Land Cover and Uses

The National Land Cover Database as cited in IDEQ (2020) provides the land uses within the subbasin unit (17010304), shown in Table 6 below. Evergreen forest and shrub/scrubland comprise of 97 percent of land cover within the subbasin.

Table 4: Land Cover within the Subbasin Unit (IDEQ, 2020)

Land Cover	Acres	Percent
Barren Land	34.25	0.003
Cultivated Crops	55.82	0.005
Deciduous Forest	421.67	0.039
Developed/High Intensity	86.51	0.008
Developed/Low Intensity	1614.84	0.149
Developed/Med Intensity	268.21	0.025
Developed/Open Space	3128.49	0.289
Emergent Herbaceous Wetlands	6325.69	0.585
Evergreen Forest	758745.55	70.168
Hay/Pasture	323.59	0.030
Herbaceous	9057.42	0.838
Mixed Forest	120.32	0.011
Open Water	1229.20	0.114
Shrub/Scrub	298176.12	27.575
Woody Wetlands	1733.60	0.160

5.3 Receiving Water

5.3.1 Physical Characteristics

The receiving water is the lower St. Joe River near St. Maries, Idaho within the St. Joe Subbasin. The Idaho NHDPlus classifies the 3.76 mile river segment receiving the discharge (Reach Code: 17010304000045) as an Order 6 stream with a segment slope of 0.034600 %, a velocity of 1.801 feet per second (fps), and a mean annual flow of 3652.690 cubic feet per second (cfs) (IDEQ, 2020). The St. Joe River and its tributaries drain a watershed of 1,192 square miles above the confluence with the St. Maries River at the city of St. Maries. The river drains the southern slopes of the St. Joe Mountains, the western slope of the Bitterroot Range, and the northern slopes of the Clearwater Mountains. The St. Joe River flows generally from east to west before entering Coeur d'Alene Lake.

The St. Joe River below St. Joe City, ID, including the section receiving the discharge from the facility, is impacted by the hydroelectric dam in Post Falls, ID, which elevates the St. Joe River 8 feet above normal summer elevation. As a result, this section of the St. Joe River is much wider than upstream waters, 270 - 300 feet compared to 145 - 250 feet upstream (IDEQ, 2011).

Proximal to the bank nearest the outfall within the action area, St. Joe River bathymetry shows depths of 5-10 feet, 30-foot depths near the opposite bank, and 25-foot depths in the center channel. Depths of 65 feet occur in riverbend pools between the discharge and Lake Chatcolet approximately six river miles downstream (CDT & Avista, 2004).

5.3.2 Water Quality

Water quality data for the receiving water is summarized in Table 5.

Table 5: Receiving Water Quality Data

Parameter	Units	Statistic	Value	Source
Aluminum	µg/L	Maximum	60	USGS NWIS station 12413875
Ammonia	mg/L	90^{th} percentile	0.02	USGS NWIS stations 12415135 and 12415140
Barium	µg/L	Single result	<100	USGS NWIS station 12415075
Boron	µg/L	Single result	<100	USGS NWIS station 12415075
Dissolved organic carbon	mg/L	Minimum	1.05	USGS NWIS station 12415140
Dissolved oxygen	mg/L	5^{th} percentile	8.6	USGS NWIS station 12415075
Hardness	mg/L as CaCO3	5th percentile	12.6	USGS NWIS stations 12415135 and 12415140
Iron	µg/L	Geometric mean	285	USGS NWIS station 12415075
Iron	µg/L	90^{th} percentile	800	USGS NWIS station 12415075
Manganese	µg/L	Geometric mean	13.4	USGS NWIS stations 12415135 and 12415140
pH	Standard units	5^{th} – 95^{th}	6.4 – 7.5	USGS NWIS stations 12415135 and 12415140
Orthophosphate, dissolved as P	µg/L	Geometric mean	6	USGS NWIS stations 12415135 and 12415140
Orthophosphate, dissolved as P	µg/L	90^{th} Percentile	11	USGS NWIS stations 12415135 and 12415140
Phosphorus, total as P	µg/L	Geometric mean	20	USGS NWIS stations 12415135 and 12415140
Phosphorus, total as P	µg/L	90^{th} Percentile	49.1	USGS NWIS stations 12415135 and 12415140
Temperature (June – Sep)	°C	95^{th} Percentile	25.5	USGS NWIS station 12415075

Parameter	Units	Statistic	Value	Source
Temperature (October – May)	°C	95th Percentile	11.8	USGS NWIS station 12415075
Temperature (year-round)	°C	95th Percentile	22.8	USGS NWIS station 12415075
Suspended Sediment (TSS)	mg/L	90th Percentile	35.6	USGS NWIS stations 12415135 and 12415140
Zinc	µg/L	Geometric mean	1.90	USGS NWIS stations 12415135 and 12415140
Zinc	µg/L	90th percentile	3.82	USGS NWIS stations 12415135 and 12415140

5.3.3 Riparian Characteristics

Riparian areas in the general vicinity of the action area have been impacted by the conversion to pastureland, the presence of logging-related activities, and other development including seasonal and permanent homes, recreational vehicle camps, and recreation areas (e.g., picnic areas). Within the St. Joe Subbasin generally, unconverted riparian communities at lower elevations are dominated by cottonwood trees (Populus spp.) Lateral wetlands found in lower floodplains include rushes (Juncus spp.), sedge (Carex spp.) and cattail (Typha latifolia). Streambank soils are considered highly erodible in the absence of vegetation (IDEQ 2003). As noted in Section V.C.1 above, the section of the St. Joe River receiving the SMWWTP's discharge is wider and deeper than waters above St. Joe City, ID due to the influence of the hydroelectric dam at Post Falls, ID. Near-stream vegetation losses and streambank erosion have resulted in increased solar loadings to the lower St. Joe River, especially outside of near-bank areas (IDEQ, 2011). Fine-textured soils in the lower river have also been impacted by boat wake (USDA, 2018). Levees were constructed along the St. Joe River for flood control purposes between September 1941 and January 1942 (USACE, 2017). These levees disrupt the natural hydrology (USDA, 2018). See Figure 8.

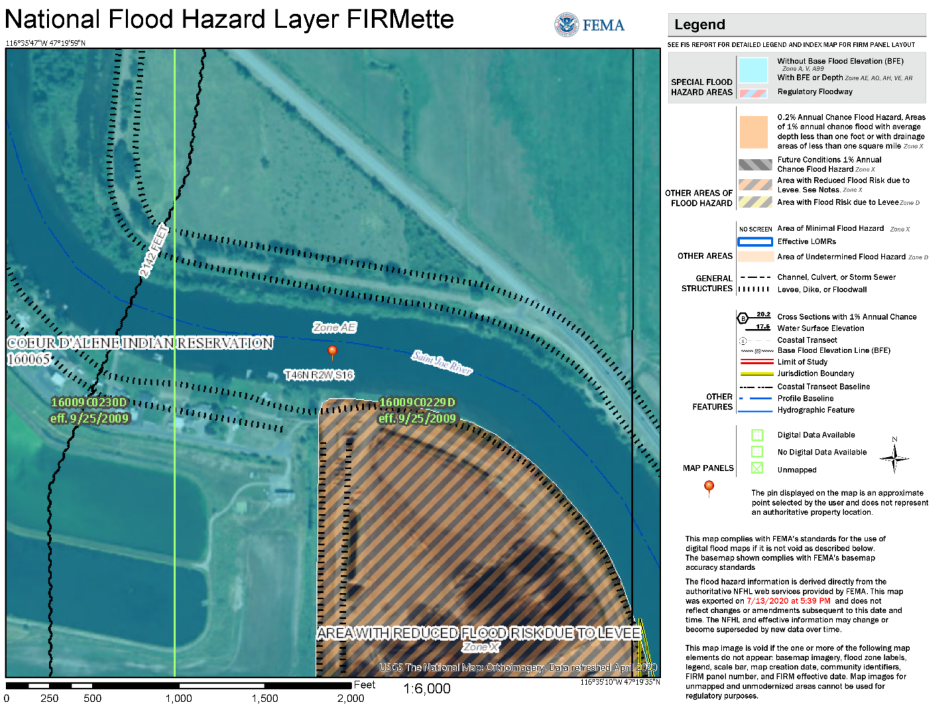

Figure 8: FEMA National Flood Hazard Layer FIR Mette

5.3.4 Sediment and Substrate

Stream beds and banks within the lower St. Joe River watershed are characterized by fine alluvial materials and deposits and fine-grained lacustrine deposits of ancient lakes (USDA, 2018). Sediment movement in the St. Joe River “occurs during bankfull or greater flows, which typically occur between November and June, or during the time of year when the Post Falls Hydroelectric Development (HED) does not control the Coeur d’Alene River’s elevation or flows (USDA, 2018).

5.4 Surface Water Monitoring Requirements

In general, surface water monitoring may be required for pollutants of concern to assess the assimilative capacity of the receiving water for the pollutant. In addition, surface water monitoring may be required for pollutants for which the water quality criteria are dependent and to collect data for TMDL development if the facility discharges to an impaired water body. Table 6 presents the proposed surface water monitoring requirements for the draft permit. Surface water monitoring results must be submitted with the DMR.

The draft permit for the City of St. Maries, which discharges to the St. Joe River very close to Outfall 001, proposes to require surface water monitoring for a number of parameters that will also be useful in reissuing this permit.[3] Since the City of St. Maries will be required to conduct surface water monitoring that can be used in reissuing this permit, EPA is proposing surface water quality monitoring requirements in the draft permit for the PotlatchDeltic St. Maries Complex that complement the requirements in the City of St. Maries permit to obtain a more robust data set.

The draft permit proposes continuous surface monitoring for temperature from July 1st – September 30th; the City of St. Maries draft permit requires such monitoring from June 1st – 30th.

EPA proposes to require surface water monitoring for aluminum and manganese. Although some water quality data were available for these metals, which were used in the reasonable potential and effluent limit calculations, aluminum data were generally only available at the Red Ives Ranger Station NWIS station, which is a long distance upstream from the facility, and nearly all of the results for manganese were collected downstream from the facility.

Table 6: Surface Water Monitoring in Draft Permit

Parameter	Units	Frequency[2]	Sample Locations	Minimum Level[3] (ML)
Temperature (July 1 – September 30)	°C	Continuous	Upstream	+/- 0.2 °C
Aluminum	µg/L	3/year	Upstream	10
Manganese	µg/L	3/year	Upstream	0.5

Footnotes:
1. The sampling type is by grab sampling for all parameters listed in table, except for continuous temperature monitoring.
2. 3/year sampling frequency is defined as December, February, and May of each year.
3. The Minimum Level must be no greater than listed.

6 Effects Analysis

This Section assesses the potential impact that effluent discharges from the PotlatchDeltic St. Maries Complex (as authorized by the Permit) would have on ESA species within the action area. Effects Determinations are discussed in Section VI.C. below. 'Effects of the action' means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Effects of the action that reduce the fitness of a listed species to meet its biological requirements may increase the likelihood that the EPA's Proposed Action will result in adverse effect to that listed species or its designated critical habitat.

6.1 Potential Stressors

The character and concentration of the chemical constituents discharged along with the wastewater effluent under the Permit for the PotlatchDeltic St. Maries Complex are evaluated as potential stressors. In general, discharge of effluent is known to affect water quality in the receiving water body. The degree to which water quality is diminished is directly related to the level of treatment and the baseline water quality.

6.2 Pollutants of Concern and Facility Effluent Characterization

Pollutants of concern are those that either have technology-based limits or may need water quality-based limits. EPA identifies pollutants of concern for the discharge based on those which:

[3] https://www.epa.gov/npdes-permits/draft-npdes-permit-city-st-maries-wastewater-treatment-plant-idaho

- Have a technology-based limit
- Have an assigned wasteload allocation (WLA) from a TMDL
- Had an effluent limit in the previous permit (or a benchmark in the MSGP)
- Are present in the effluent monitoring. Monitoring data are reported in the application and DMR and any special studies
- Are expected to be in the discharge based on the nature of the discharge

Based on this analysis, pollutants of concern are as follows:

- Aluminum
- Ammonia
- Barium
- Boron
- Color
- Debris
- Iron
- Manganese
- Nitrogen (nitrate-nitrite, total Kjeldahl nitrogen)
- Oxygen-demanding pollutants (COD, BOD5)
- pH
- Phenolic compounds
- Phosphorus
- Temperature
- TSS
- Zinc

Monitoring is performed to determine compliance with effluent limitations established in NPDES permits, establish a basis for enforcement actions, assess treatment efficiency, characterize influent and effluent, and characterize receiving water. To characterize the effluent, the EPA evaluated the facility's application form and discharge monitoring report (DMR) data. The effluent quality is summarized in Table 7 below.

Table 7: Effluent Characterization

Parameter	Units	Minimum	Average	Maximum	Standard Deviation	Count	Source
Aluminum, total	µg/L	570	570	570	N/A	1	Application
Ammonia, total as N	mg/L	0.06	0.41	1.2	0.44	6	Application and individual permit DMR data
Barium, total	µg/L	88	88	88	N/A	1	Application
Biochemical oxygen demand, 5-day	mg/L	6	22	48	18	6	Application and individual permit DMR data
Boron, total	µg/L	40	40	40	N/A	1	Application
Chemical oxygen demand	mg/L	62.8	150	299	66	10	MSGP DMR Data
Color	Color units	90	90	90	N/A	1	Application
Flow	mgd	0.0001	0.1705	1.1000	0.1294	276	Individual permit DMR data

Parameter	Units	Minimum	Average	Maximum	Standard Deviation	Count	Source
Iron, total	µg/L	6660	6660	6660	N/A	1	Application
Manganese, total	µg/L	1820	1820	1820	N/A	1	Application
Oxygen, dissolved	mg/L	2.72	8.98	16.5	6.83	5	Individual permit DMR data
pH	s.u.	6.0	N/A	8.1	N/A	276	Individual permit DMR data
Phosphorus, total as P	mg/L	0.22	0.52	0.86	0.26	6	Application and individual permit DMR data
Solids, total suspended	mg/L	27	78.2	215	57.5	10	MSGP DMR data
Temperature (daily max.)	°C	3	12.8	27.9	5.7	274	Individual permit DMR data
Total phenols	µg/L	300	300	300	N/A	1	Application
Turbidity	NTU	21.6	107	364	146	5	Individual permit DMR data
Zinc, total	µg/L	27	86	172	48	10	MSGP DMR data

6.3 Impacts of Pollutants on ESA Species

As discussed in Section 4.1.2.2 of this BE, the action is expected to have no effect on the North American wolverine given the unlikelihood of their occurrence within the action area. As such, the following section focuses exclusively on potential impacts of pollutants on bull trout that may occur within the action area and bull trout critical habitat.

6.3.1 5-Day Biochemical Oxygen Demand (BOD5) and Dissolved Oxygen (DO)

Effluent often contains organic materials that are ultimately broken down by instream microorganisms, which use oxygen in the process. BOD is a measure of the amount of oxygen these organisms use when breaking down such organics. Hence, there is a relationship between effluent BOD and dissolved oxygen (DO) in receiving waters, with higher BOD loads generally resulting in lower instream DO concentrations. However, DO in streams is dependent on a range of factors including water temperature, sediment quality, other oxygen consuming processes, DO reintroduction by aquatic plants, stream flow, and aeration. Oxygen levels are highest in the surface water portion of freshwater rivers. Atmospheric exchange occurs at the surface and sufficient light can penetrate surface waters to allow the oxygen-releasing processes of photosynthesis to occur (John C Davis, 1975). In the euphotic zone, photosynthesis may exceed respiration and there is a net production of oxygen; below the euphotic zone, a net consumption of oxygen occurs (J. C. Davis, 1975; Randall & Smith, 1967).

Oxygen is essential for the respiration of most freshwater organisms. Reduced oxygen levels have been shown to cause lethal and sublethal effects (physiological and behavioral) in a variety of organisms, especially in fish. Physiological studies indicate that reduced DO levels restrict the ability of fish to maximize metabolic processes (Birtwell, 1989). Consequently, the growth rates of fish are affected by reduced DO levels; reductions in the growth rate of salmon have been recorded at levels as high as 7 mg/L (USEPA, 1986a). Sockeye salmon showed signs of elevated blood and buccal pressure and an increased breathing rate at concentrations below 5.07 mg/L (Randall & Smith, 1967). Mortality occurs when salmonids are exposed to DO concentrations below 3.0 mg/L for 3.5 days or more (USEPA, 1986a).

For the following reasons, the EPA concludes that the discharge of BOD5 is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area and bull trout that are present would only be present briefly as they migrate through the area.
- Monitoring data reveals that water quality standards for DO in the St. Joe River are consistently met or exceeded.
    - Over 40 years of combined receiving water monitoring data for dissolved oxygen shows a 5th percentile (critical low) concentration value of 9.1 mg/L, well above levels at which mortality occurs, and generally consistent with salmonid species fitness.
- The effluent loading of oxygen demanding pollution is small, thus, discharge does not cause or contribute to a violation of dissolved oxygen criteria in the receiving water.
- Literature indicates that salmonids actively avoid waters with low dissolved oxygen (Hicks, 2002). Therefore, it is likely that migrating bull trout can avoid any short-term DO depressions with the plume resulting from the discharge.
- Any potential effects resulting from the discharge of BOD5 are expected to be short-term, transient, unmeasurable, and therefore insignificant.

Commented [SSP6]: Does this data include measurements downstream of outflow 001?

6.3.2 Total Suspended Solids (TSS), Sediment and Turbidity

TSS, suspended sediment and turbidity provide different measurements of suspended particles in water, however, information on suspended sediment and turbidity addresses the same general effects to fish species. Movement of TSS into streams and estuaries is a natural process occurring through surface and streambank erosion. Ephemeral high concentrations of suspended sediments that occur during storms and snowmelt runoff may have short term effects on biota such as behavior response (e.g. avoidance). But, prolonged exposure to high concentrations of suspended solids may harm fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion. Settling of suspended sediment can reduce quality and availability of substrate habitat.

In freshwater, avoidance of turbid water and disruption of feeding and territorial behavior (in the range of 60 – 70 NTU) has been documented for juvenile salmonids. Newly emerged fry appear to be more susceptible to even moderate turbidities than are older fish. Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities (Bjornn & Reiser, 1991).

Although the mechanism for effects of suspended sediment is well understood, there is a wide diversity of response to specific concentrations of TSS. Newcombe and Jensen (1996) provided a synthesis for evaluating risk and impacts based on an extensive literature review. Four categories of effects resulting from exposure to TSS were recognized in fish: lethal, paralethal, sublethal, and behavioral. These four effect categories are defined as follows: lethal effects are those that result in mortality; paralethal effects are those that reduce the population in time such as reduced growth rate; sublethal effects are reduced feeding rate or feeding success and physiological stress; and behavioral effects are avoidance, alarm, or movement from cover. Vulnerability to TSS effects varies with life history phase, juvenile and larval salmonids are more susceptible to TSS than adults. Pre-emergent larvae and eggs are considered the most susceptible, resulting in reduced survival and hatching.

Section 19(2)(b) of the CDT WQS includes the following EPA-approved numeric criterion for total suspended solids, for agricultural water supply uses: The concentration of total suspended solids is not to exceed an arithmetic mean of 75 mg/L during periods when the surface water is used an agricultural water supply, based on a minimum of three samples.

The CDT WQS do not include numeric water quality criteria for TSS for other beneficial uses. EPA-approved sediment TMDLs for Idaho rivers that have been established to protect aquatic life uses generally have lower TSS concentration targets with shorter averaging periods relative to the 75 mg/L arithmetic mean criterion for agricultural water supply uses. For example, the Potlatch River Subbasin Assessment and TMDLs establishes a monthly average TSS target of 50 mg/L and a maximum daily target of 80 mg/L (IDEQ, 2008).

EPA proposes to implement the agricultural water supply criterion for TSS without a mixing zone, as an average monthly limit set equal to the arithmetic mean criterion of 75 mg/L. The proposed maximum daily limit of 165 mg/L is based on the average monthly limit and observed effluent variability, as described in Table 5-3 of the TSD (USEPA, 1991). Although these limits are based on the criterion for agricultural water supply, EPA believes these limits will ensure protection of more sensitive beneficial uses such as aquatic life after mixing. A discharge at the proposed maximum daily limit of 165 mg/L TSS will result in TSS concentrations of 42 and 39 mg/L at the edges of the acute and chronic mixing zones.

Commented [SSP7]: Provide rationale. Previous paragraph indicates EPA-approved TMDLs for aquatic life uses in Idaho are lower than those used for agriculture.

In addition to TSS, the CDT WQS also establish criteria for turbidity. However, EPA partially disapproved the numeric turbidity criteria in Provisions 19(1)(a) and 19(4)(a)(iv) of the CDT WQS (i.e., not in effect for CWA purposes). In addition to the disapproved numeric criteria, Section 5(5) of the CDT WQS establishes a narrative criterion for turbidity: “Turbidity shall not be at a level to impair designated uses or aquatic biota.” As explained above, EPA has proposed water quality-based effluent limits for TSS. EPA believes the TSS limits will ensure compliance with the Tribe’s narrative criterion for turbidity.

For the following reasons, the EPA concludes that the discharge of TSS is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area and bull trout that are present would only be present briefly as they migrate through the area.
- Water quality-based limits have been included in the Permit that will effectively control TSS in the effluent; and ensure that narrative CDT WQS for turbidity are met.
- Any potential effects resulting from the discharge of TSS are expected to be short-term, transient, unmeasurable, and therefore insignificant.

Commented [SSP8]: Please explain rationale for critical habitat. There will be some constant level, even if below limits, of TSS input to the river. Sedimentation (i.e., substrate embeddedness) is measureable.

6.3.3 Aluminum

There is only one effluent sample available for aluminum (reported on the application), which was 570 µg/L. This means the effluent concentration of aluminum is uncertain, and this uncertainty is represented in the reasonable potential analysis as a large reasonable potential multiplying factor of 13.2 (see USEPA (1991) at Table 3-1). If more effluent data were available for aluminum, the reasonable potential multiplying factor would be smaller, and this may result in a finding that the discharge does not have the reasonable potential to cause or contribute to excursions above water quality standards for aluminum. The upstream concentration of aluminum is uncertain as well. Because of the uncertainty in the effluent and upstream concentrations of aluminum, EPA has proposed effluent and surface water monitoring requirements for aluminum in the draft permit. The draft permit for the nearby City of St. Maries wastewater treatment plant proposes surface water monitoring requirements for pH, DOC, and hardness.

EPA published revised 304(a) aquatic life criteria for aluminum in freshwater in December 2018.[4] The aluminium 304(a) criteria use Multiple Linear Regression (MLR) models to normalize the toxicity data upon which each criteria value calculation is based. The toxicity data and therefore the criteria values are calculated based on a site's pH, total hardness, and dissolved organic carbon (DOC).

Two DOC results are available from NWIS station 12415140 (St. Joe River Near Chatcolet, ID), which is downstream from the facility. These samples were also analyzed for pH and hardness. EPA used the aluminum criteria calculator to calculate the values of the acute and chronic water quality criteria based on these two contemporaneous sets of DOC, hardness and pH data. The results are shown in Table 8.

Table 8: Aluminum Criteria Calculator Results

Date	DOC (mg/L)	Hardness (mg/L as $CaCO_3$)	pH	Acute aluminum criterion (µg/L)	Chronic aluminum criterion (µg/L)
7/18/2005	1.05	25.6	7.1	720	350
8/25/2005	1.52	29.7	6.8	630	280

Although there were only two DOC results available for the receiving water, there were 100 contemporaneous sets of pH and hardness data available at USGS stations 12415135 and 12415140. EPA calculated the values of the aluminum criteria for each pair of contemporaneous pH and hardness values, using the lower of the two DOC concentrations measured (1.05 mg/L) for use in the reasonable potential analysis in the fact sheet. EPA also used the vertebrate MLR equation to calculate LC50 and EC20 values for the genus *Salvelinus* for each paired water chemistry sample within this data set. Each of these LC50 and EC20 values were divided by Taxonomic Adjustment Factors (TAFs) (1.967 or 1.696, respectively) to estimate the LC05 and EC05 values used in the effects analysis described below. TAFs were calculated from by dividing high effects concentrations (LC50 or EC20) by low effects concentrations (LC05 or EC05) that were obtained from concentration-response (C-R) curves from toxicological studies conducted in surrogate fish species. Further methods information can be found in USEPA (2020a).

To evaluate the effects of the discharge of aluminum upon bull trout, EPA obtained river flow data concurrent with 92 of the 100 pH and hardness measurements (concurrent flow data was not available for the other 8 pH and hardness measurements). EPA then calculated dilution factors based on the daily river flows using mixing zone sizes of 20% and 25% of the daily river flows. Using these daily dilution factors, EPA calculated a mixed aluminum concentration for each of the 92 days with flow, pH, and hardness data, and compared these mixed aluminum concentrations to the corresponding aluminum water quality criteria and the EC05 values for *Salvelinus* species. The effluent flow was held constant at the maximum reported flow of 1.1 mgd (1.70 CFS) and the effluent aluminum concentration was held constant at the maximum projected concentration of 7,524 µg/L, (i.e., the measured effluent concentration of 570 µg/L multiplied by the reasonable potential multiplying factor of 13.2). None of the mixed aluminum concentrations exceeded the corresponding acute or chronic water quality criteria or the *Salvelinus* LC05 or EC05 values. Since the concentration of aluminum, after mixing, will consistently be below the water quality criteria and the LC05 and EC05 for *Salvelinus* species, EPA has determined that the discharge of aluminum is not likely to adversely affect bull trout.

[4] https://www.epa.gov/wqc/aquatic-life-criteria-aluminum

6.3.4 Ammonia

Ammonia occurs naturally in water at low concentrations in equilibrium with other inorganic nitrogen compounds. Ammonia is highly soluble in water and its speciation is affected by a wide variety of environmental parameters including pH, temperature, and ionic strength. In aqueous solutions, an equilibrium exists between un-ionized (NH3) and ionized (NH4 +) ammonia species, with unionized ammonia generally being the most toxic form in the aquatic environment. Direct toxic effects from ammonia in water include death and reduced growth and reproductive success. Indirect effects include overall impacts on the ecosystem, such as acidification (Constable et al., 2003).

Concentrations of ammonia acutely toxic to fishes may cause loss of equilibrium, hyper-excitability, increased breathing, cardiac output and oxygen uptake, and, in very high concentrations, convulsions, coma, and death. At lower concentrations ammonia may contribute to a reduction in hatching success and growth rate, morphological development, and pathologic changes in tissues of gills, livers, and kidneys (USEPA, 1999a). Factors that have been shown to affect ammonia toxicity include dissolved oxygen concentration, temperature, pH, previous acclimation to ammonia, fluctuating or intermittent exposures, carbon dioxide concentration, salinity, and the presence of other toxicants (USEPA, 1999a). Invertebrates are generally more tolerant than fishes to the acute and toxic effects of ammonia (USEPA, 1986b).

Fish are adept at sensing and avoiding very low concentrations of ammonia. It has been demonstrated that rainbow and cutthroat trout can withstand short-term, acutely-toxic ammonia concentrations without suffering any obvious long-term effects so long as fish are able to subsequently recuperate in sub-toxic concentrations, and that such exposure to acutely toxic pulses acclimatizes fish such that future exposure(s) may be more readily withstood (Thurston, Russo, & Vinogradov, 1981). A study by Brinkman, Woodling, Vajda, and Norris (2009) concluded that hatch rates and survival of rainbow trout fry were not affected by ammonia exposure. However, ammonia-nitrogen concentrations of 16.8 mg/L significantly affected the survival, growth, and biomass of swim-up fry. Exposure to concentrations of 7.44 mg/L or less had no effect, and fish exposed to such concentrations generally recovered, showing no long-term gill damage.

When applying a 25 percent mixing zone for ammonia using the 30B3 (chronic) and 1Q10 (acute) low flows, the PotlatchDeltic St. Maries Complex does not have a reasonable potential to contribute to violations of water quality standards in the receiving water beyond the edge of the chronic mixing zone, and an effluent limit was not included in the Permit. Predicted maximum concentrations at the edge of the mixing zone are 256 and 95 µg/L for acute and chronic compared to calculated pH- and temperature-dependent water quality standards of 13,283 (acute) and 2,559 µg/L (chronic).

For the following reasons, the EPA concludes that the discharge of ammonia is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area.
- Migrating trout are not expected to remain in the discharge plume for long periods of time.
- USGS data show low ambient concentrations of ammonia (Table 5).
- Any potential effects resulting from the discharge of ammonia are expected to be short-term, transient, unmeasurable, and therefore insignificant.

6.3.5 Barium

EPA has not published recommended aquatic life water quality criteria for barium, although it has published a recommended human health criterion for the consumption of water and organisms, which is 1000 µg/L (USEPA, 1986b). EPA found that the discharge does not have the reasonable potential to cause or contribute to excursions above this recommended criterion, thus no effluent limits are proposed for barium.

EPA Region 4 has established ecological screening values (ESVs) for barium in freshwater. ESVs are based on chemical concentrations associated with a low probability of unacceptable risks to ecological receptors (USEPA, 2018). The Region 4 ESVs a chronic value of 220 µg/L and an acute value of 2,000 µg/L.

EPA also searched the ECOTOX database (https://cfpub.epa.gov/ecotox/) for relevant toxicity data for the barium chemical group. The lowest effect concentration was 1,000 µg/L, which was the LC50 for *Hyalella azteca* reported by Borgmann, Couillard, Doyle, and Dixon (2005) and the concentration for observed stress (with no endpoint specified) for the snail *Biomphalaria glabrata* reported by Harry and Aldrich (1963).

The effluent barium concentration reported on the application was 88 µg/L. Since this is lower than the EPA Region 4 ESVs and documented effects concentrations for aquatic organisms, the discharge of barium is not likely to adversely affect bull trout.

6.3.6 Boron

EPA has not published recommended aquatic life water quality criteria for boron, although it has published a recommended criterion for irrigation of sensitive crops, which is 750 µg/L (USEPA, 1986b). EPA found that the discharge does not have the reasonable potential to cause or contribute to excursions above this recommended criterion for irrigation of sensitive crops, thus no effluent limits are proposed for boron.

The Region 4 ESVs for boron are a chronic value of 7,200 µg/L and an acute value of 34,000 µg/L (USEPA, 2018).

EPA searched the ECOTOX database (https://cfpub.epa.gov/ecotox/) for relevant toxicity data for boron. The lowest relevant effect concentration was 100 µg/L, which was the lowest observed effect concentration (LOEC) for rainbow trout mortality reported by Black, Barnum, and Birge (1993).

Eisler (1990) reports that concentrations of boron that are nonhazardous to aquatic organisms range from 1,000 - 5,000 µg/L, which is consistent with the ECOTOX data. Wesley J. Birge, Black., and Black (1977) reported LC01 concentrations for embryos of channel catfish (*Ictalurus punctatus*) and goldfish (*Carassius auratus*) of 200 µg/L, while the LC01 for rainbow trout embryos ranged from 1 µg/L to 100 µg/L, depending on the hardness of the water and the form of boron used. However, the St. Joe River near the point of discharge is not designated for salmonid spawning and is not suitable for this use. Thus, salmonid eggs would not be exposed to the effluent.

The effluent boron concentration reported on the application was 40 µg/L. Since this is lower than the EPA Region 4 ESVs and documented effects concentrations for aquatic organisms (except for rainbow trout embryos, which would not be exposed to the effluent), the discharge of boron is not likely to adversely affect bull trout.

6.3.7 Debris

The draft permit prohibits the discharge of debris, which is defined as “bark, twigs, branches, heartwood or sapwood that will not pass through a 2.54 cm (1.0 in) diameter round opening.” Since the permit does not authorize discharge of this material, there will be no effect upon bull trout from this pollutant.

6.3.8 Iron

6.3.8.1 Iron at PotlatchDeltic St. Maries Complex

The Coeur d’Alene Tribe’s WQS do not include numeric water quality criteria for iron. The EPA has interpreted the Tribe’s narrative criterion for toxic substances using the EPA’s recommended chronic criterion of 1,000 µg/L iron. EPA has determined that the discharge from Outfall 001 has the reasonable potential to cause or contribute to excursions above the 304(a) criterion for iron. Even though there is only one effluent sample for iron, and this results in a large reasonable potential multiplying factor of 13.2 (see the TSD at Table 3-1), the measured effluent concentration of iron is high enough that additional effluent samples (which would result in a smaller reasonable potential multiplying factor) are not likely to change the outcome of the reasonable potential analysis. The draft permit therefore proposes water quality-based effluent limits for iron, for Outfall 001, which ensure compliance with the recommended chronic criterion at the edge of the chronic mixing zone.

6.3.8.2 Water-column exposure toxicity data - chronic criterion for iron in freshwater

Iron can exist in two valence states in freshwater. The most studied valence state is ferrous or divalent iron (Fe+2), which is water soluble at any pH and can be released from sediment to surface water under anaerobic conditions. Water solubility of ferrous iron can exceed 100,000 µg/L under circumneutral pH conditions.

Toxicity of ferric or trivalent iron (Fe+3) is less well studied, due to its negligible water solubility. At pH > 3.5 ferric iron precipitates out of solution, forming a flocculant or solid material commonly known as yellowboy. At pH > 5, the water solubility of ferric iron is approximately 10 µg/L. Above 10 µg/L the ferric iron is present only in a suspension or complexed form (Hem & Cropper, 1962). Yellowboy can elicit toxicity in aquatic species by coating or covering gills or respiratory surfaces, causing suffocation. However, this toxicity is a physical toxicity, not a chemical toxicity, and will not be discussed further in this BE.

The original iron criterion (USEPA, 1976), unlike most EPA metals criteria, is expressed in terms of total recoverable iron. Nearly all other EPA aquatic life criteria for metals are expressed in terms of the dissolved metal.

None of the action area listed species in freshwater had empirical iron chronic toxicity data available at the time of publication of the USEPA (1976) iron criteria. The USEPA (1976) chronic iron criterion was based on a limited data set which included several field surveys describing the presence or absence of fish at various iron concentrations. USEPA (1976) did not refer to any of several chronic toxicity studies performed by Sykora and co-workers (E. J. Smith & Sykora, 1976; J. Sykora, Smith, Synak, & Shapiro, 1975; J. L. Sykora, Smith, & Synak, 1972; Updegraff & Sykora, 1976) mostly with brook trout (Salvelinus fontinalis), a salmonid in the same genus as bull trout (Salvelinus confluentus), but also several studies with coho salmon (Oncorhynchus kisutch).

A close reading of J. L. Sykora et al. (1972) indicates that Figure 5 of the paper combined with information in the text of the study contains sufficient information to qualitatively estimate a 35-day (5-

week) NOEC for growth of brook trout. This 5-week growth NOEC is approximately 12,000 µg/L total iron, the nominal exposure concentration for one of the four exposure concentrations studied. The mean iron concentration in the nominal 12,000 µg/L exposure during this 35-week long study was 13,420 µg/L, ranging between 7700 – 19,000 µg/L. Brook trout growth in the nominal 6000 µg/L iron concentration (mean = 7800 µg/L) for the entire 35-week duration of the study was not significantly different from growth in controls

6.3.8.3 Additional chronic toxicity data for iron published since 1976

Brenner and Cooper (1978) studied the effects of iron hydroxide on coho salmon (Oncorhynchus kisutch) in a 90-day exposure, starting with fertilized eggs and continuing to the alevin stage. No effect on the hatchability, embryonic development, survival and maturation of coho salmon exposed to 3000 µg/L iron was observed at the end of the 90-day exposure. Unfortunately, Brenner and Cooper (1978) only exposed fish to the one concentration of 3000 µg/L, making the study unusable in aquatic life criteria development (a minimum of three exposure concentrations plus a control are required for a study to be considered for criteria development).

The EPA ECOTOX database (https://cfpub.epa.gov/ecotox/) provides limited information about a development study with rainbow trout performed by Amelung (1982). ECOTOX provides insufficient information about the Amelung (1982)study to determine if it meets quality assurance requirements for inclusion in this effects assessment, specifically with respect to the actual toxicological endpoint measured, whether the effect is a LOEC, NOEC or an ECx value, the number of exposure concentrations tested and the duration of exposure. The Amelung (1982) study is in an obscure journal (Archiv für Fischereiwissenschaft), and the study could not be obtained by EPA Region 10. However, since this appears to be the only available chronic toxicity study showing iron effects on a listed species within the action area, it is worthwhile to mention the reported effect concentration on trout development of 5700 µg/L, higher than the 1000 µg/L iron chronic criterion concentration.

Cadmus, Brinkman, and May (2018) performed 30-day chronic growth toxicity studies on two members of the family Salmonidae, although neither is a listed species within the action area. The 30-day growth EC20 concentrations were >5146 µg/L and 1318 µg/L for brown trout (Salmo trutta) and mountain whitefish (Prosopium williamsoni), respectively. As all data quality requirements for aquatic life criteria derivation appear to have been met in Cadmus et al. (2018), the 30-day growth EC20 concentration for mountain whitefish will be assumed to be the lowest chronic minimum effect threshold concentration for all listed salmonid species in the freshwater portions of the action area.

In recent years as discussed in the BE methodology, the use of chronic EC20 concentrations has increasingly replaced and is preferred over the use of NOECs, NOELs and MATCs as the reported chronic no effect concentration. This is because of both statistical and biological concerns with NOECs, NOELs and MATCs. In particular, statistical no effect or insignificance, as implied in a NOEC or NOEL does not guarantee ecological, biological, or ecotoxicological insignificance.

6.3.8.4 Acute-chronic ratio for iron

Because an empirical 30-day chronic growth toxicity study exists for a fish species in the same family (Salmonidae) that contains all of the listed species in the action area, the minimum chronic effect threshold concentration for listed species is estimated by assuming the lowest empirically measured minimum chronic effect threshold concentration is as low or lower than any minimum chronic effect threshold concentration for any salmonid species. Using this assumption, use of an acute-chronic ratio

(ACR) to convert an iron 4-day LC50 to a chronic NOEC is not needed to complete the effects assessment for the chronic iron criterion

6.3.8.5 Effects assessment of chronic iron criterion on listed species

The lowest chronic minimum effect threshold concentration for any salmonid species is 1,318 µg/L, the mountain whitefish 30-day EC20 for growth. This value is higher than the iron chronic criterion of 1000 µg/L. Assuming that the minimum chronic effect concentration for bull trout is greater than or equal to 1,318 µg/L, EPA determines that the effluent limits in the draft permit, which will ensure compliance with the iron chronic criterion of 1,000 µg/L at the edge of the chronic mixing zone, are not likely to adversely affect bull trout.

6.3.9 Manganese

EPA has not published recommended aquatic life water quality criteria for manganese, although it has published recommended human health criteria. There is only one effluent sample available for manganese (reported on the application). This means the effluent concentration of manganese is uncertain, and this uncertainty is represented in the reasonable potential analysis for human health criteria as a large reasonable potential multiplying factor of 2.49. If more effluent data were available for manganese, the reasonable `potential multiplying factor would be smaller, and this may result in a finding that the discharge does not have the reasonable potential to cause or contribute to excursions above water quality standards for manganese. Most of the available data for manganese in the receiving water were collected downstream of the discharge. Because of the uncertainty in the effluent and upstream concentrations of manganese, EPA has proposed effluent monitoring and surface water requirements for manganese in the draft permit. No effluent limits are proposed for manganese.

Commented [SSP9]: Why is this different than the mult factor of 13.2 used for other components w/ only one sample?

The Region 4 ESVs for manganese are a chronic value of 93 µg/L and an acute value of 1,680 µg/L (USEPA, 2018).

EPA searched the ECOTOX database (https://cfpub.epa.gov/ecotox/) for relevant toxicity data for the manganese chemical group. The lowest concentration of manganese causing an effect with a specified endpoint upon the mortality, reproduction, growth, or behavior of a freshwater organism was 150 µg/L, which was the LC50 for Harpacticoid Copepod (*Canthocamptus sp.*) larvae as reported by Rama Rao and Nath (1983). The lowest concentration of manganese causing an effect with a specified endpoint upon the mortality, reproduction, growth, or behavior of a freshwater fish was an LC01 for rainbow trout (*Oncorhynchus mykiss*) eggs of 388 µg/L, reported by Wesley J Birge, Black, and Ramey (1981). However, since salmonid spawning does not occur in the action area, salmonid eggs would not be exposed to the effluent.

A discharge of manganese at 24,018 µg/L, which is the concentration reported on the permit application (1,820 µg/L) multiplied by the reasonable potential multiplying factor of (13.2), would result in 1,267 µg/L at the edge of the acute mixing zone and 645 µg/L at the edge of the chronic mixing zone. The concentration at the edge of the acute mixing zone is below the acute ESV, but the concentration at the edge of the chronic mixing zone is higher than the chronic ESV. However, these relatively high concentrations are due in part to the large reasonable potential multiplying factor. At the measured effluent concentration, the concentrations at the edges of the chronic and acute mixing zones are 74 µg/L and 121 µg/L, respectively, which are below the respective ESVs.

Commented [SSP10]: Are these reversed? Otherwise, why would the acute level be lower than the chronic level in this example?

Since a discharge of manganese at the measured effluent concentration would result in concentrations lower than the EPA Region 4 ESVs and concentrations known to affect aquatic organisms (including salmonid eggs) at the edges of the mixing zones, the discharge of manganese is not likely to adversely affect bull trout.

6.3.10 Nutrients

Eutrophication of freshwater systems resulting from excessive nutrient inputs profoundly impacts many aquatic ecosystems. Common nutrient sources include agriculture, aquaculture, stormwater, wastewater, and home/lawn/landscape fertilizers. In freshwater systems, phosphorus is a limiting nutrient, and excessive phosphrous enrichment is a primary causal agent of algal proliferation in these systems. While nutrient enrichment influences eutrophication, other influences include hydrodynamics, temperature, CO2, and microbes (Yang, Wu, Hao, & He, 2008).

Impacts to habitat and species include: the loss of species presence, composition, and diversity due to algal influences on river substrates; depressed dissolved oxygen levels resulting from decomposition of oxygen-depleting algae and excessive aquatic vegetation; food web disruption (e.g., new predators), turbidity and reduced sunlight associated with algae and vegetation; health effects associated with toxic algal blooms; and clogged fish gills (Biggs, 2000; V. H. Smith & Schindler, 2009; USEPA, 2020b).

The CDT WQS do not establish numeric nutrient criteria for the receiving water. Section 5(4) of the CDT WQS includes narrative criteria: “nutrients or other substances from anthropogenic causes shall not be present in concentrations which will produce objectionable algal densities or nuisance aquatic vegetation, result in a dominance of nuisance species, or otherwise cause nuisance conditions.”

Reasonable potential was not found when evaluating Total P and N against the narrative criteria. The draft permit proposes Total P and orthophosphate monitoring in the effluent. In-stream Total P and orthophosphate data were also available. The 90th percentile Total P level measured in the receiving water downstream from the facility was 49 µg/L and the geometric mean concentration was 20 µg/L (Table 5). The 90th percentile concentration is below EPA’s recommendation for preventing biological nuisances and to control accelerated or cultural eutrophication in streams flowing to lakes and reservoirs, which is 50 µg/L (USEPA, 1986b).

Phosphorus is generally the limiting nutrient (i.e., the nutrient that controls primary productivity) in freshwaters, and particularly in lakes and reservoirs. No effluent limits are proposed for nitrogen, including ammonia.

The draft permit requires the facility to monitor the effluent for total phosphorus, orthophosphate, total Kjeldahl nitrogen, nitrate-nitrite, and ammonia (as nitrogen) given the Lake Management Plan’s stated goal of limiting basin-wide nutrient inputs that impair lake water quality conditions (IDEQ&CdAT, 2009). These monitoring requirements will be used to assess if limits may be required in future permitting actions.

For the following reasons, the EPA concludes that phosphorus and nitrogen in the effluent is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Observed receiving water and effluent phosphorus levels are not consistent with excessive plant and algae growth.

- Phosphorus release from sediments and algal blooms are encouraged by elevated temperatures, with algal blooms occurring between 23 – 28 °C (Yang et al., 2008).
- Critical dissolved oxygen levels in the receiving water (5th percentile value of 9.1 mg/L) are not indicative of persistent oxygen-depleting eutrophic agents.
- Any potential effects resulting from the discharge of nutrients are expected to be short-term, transient, unmeasurable, and therefore insignificant.

6.3.11 pH

Sections 19(1), (2), and (4) of the CDT WQS establish pH criteria for three use classifications: Domestic Water Supply; Agricultural Water Supply; and Bull Trout and Cutthroat Trout. pH must be maintained within the range of 6.5 to 8.5, with a human caused variation within this range of less than 0.5 units over any 24-hour period.

No mixing zones are authorized for pH, and the draft permit establishes pH effluent limits of 6.5 – 8.5 standard units.

On May 9, 2014, USFWS provided concurrence on EPA's not likely to adversely affect determination for EPA approval of the Tribe's criteria for pH (Ref No. 01EIFW00-2014-1-0110). Because the draft permit implements the Tribe's pH criteria at the end-of-pipe, the pH of the discharge is not likely to adversely affect bull trout.

Commented [SSP11]: Should be the letter "I"

6.3.12 Phenolic Compounds

Commented [SSP12]: Is there any literature/data/evidence of the effects to aquatic organisms from these compounds? If not, please state as such, as well as any assumptions made as to potential effects to aq orgs.

The permit application states that phenolic compounds from wood and bark may be present in the discharge. The permit application also reported a result (from a single analysis) of 0.3 mg/L (300 µg/L) total phenols. The permittee used EPA method 420.1 for the analysis of total phenols. It is not possible to differentiate between different kinds of phenols using this method; however, it does provide an upper bound for the concentration of any given phenolic compound. EPA has promulgated recommended aquatic life criteria for nonylphenol and pentachlorophenol.[5]

A study of stormwater quality of a log storage and handling facility in Louisiana found that concentrations of 4-chloro-3-methylphenol; 2-chlorophenol; 2,4-dichlorophenol; 2,4-dimethylphenol; 2,4-dinitrophenol; 2-methyl-4,6-dinitrophenol; 2-nitrophenol; 4-nitrophenol; pentachlorophenol; phenol; and 2,4,6 trichlorophenol were below detection limits, which ranged from 10 - 50 µg/L (deHoop et al., 1998). Nonylphenol was not analyzed.

For the following reasons, the EPA concludes that phenolic compounds in the effluent are NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area.
- Migrating trout are not expected to remain in the discharge plume for long periods of time.
- Concentrations of priority pollutant phenolic compounds in runoff from log storage are less than 10 - 50 µg/L (deHoop et al., 1998).
- Any potential effects resulting from the discharge of phenolic compounds are expected to be short-term, transient, unmeasurable, and therefore insignificant.

Commented [SSP13]: May be less. Small sample size does not indicate certainty as implied here. Additionally, pentachlorophenol criteria for aquatic organisms is 19/15 ug/L, which suggests that effects may occur even at levels that are below detection limits.

[5] https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

6.3.13 Temperature

Water temperature is one of the most important physical factors affecting freshwater organisms. Metabolic rate and the reproductive activities of aquatic life are controlled by water temperature. Metabolic activity increases with a rise in temperature, thus increasing a fish's demand for oxygen; however; an increase in stream temperature also causes a decrease in DO, limiting the amount of oxygen available to these aquatic organisms. With a limited amount of DO available, the fish in this system will become stressed. A rise in temperature can also provide conditions for the growth of disease-causing organisms. Chemical equilibrium constants, solubility, and the rates of chemical reactions are temperature dependent (Whitehouse, 1984). Water temperature for streams varies with season, elevation, geographic location, and climatic conditions and is influenced by stream flow, streamside vegetation, groundwater inputs, and water effluent from industrial activities.

Most freshwater organisms are poikilotherms (i.e., cannot regulate their internal temperatures). As a result, biological processes, such as photosynthetic and respiration rates, spawning, uptake of toxic substances, and behavioral patterns, are all responsive to changes in temperature (Aiken & Waddy, 1990; Houston, 1982; Strickland, 1965). Because water temperature is important to biological process and the freshwater environment is variable with respect to temperature, organisms must be responsive to this variability. Many freshwater organisms can adjust to alterations in ambient water temperatures through a variety of biological responses. This ability to acclimate, can include behavioral, morphological, physiological, or biochemical responses. The length, frequency, and severity of exposure to temperature extremes, as well as thermal history, are important determinants of an individual organism's response to temperature changes and ability to acclimate (Fry, 1971; Somero & Hochachka, 1971; Thompson & Newell, 1985).

Water temperature affects the distribution, health, and survival of native salmonids and other aquatic organisms by influencing their physiology and behavior. Temperature-dependent life stages for salmonids include spawning, egg incubation, emergence, rearing, smoltification, migration, and pre-spawn holding. Small increases in temperatures (e.g., 2-3°C) above biologically optimal ranges can begin to reduce salmonid fitness in some of these life stages (Poole et al., 2001).

Bull trout have been recorded in a wide range of water temperatures (0 – 30 °C in literature), but seemingly seek the colder/coldest water habitats available. Further, while bull trout appear able to tolerate elevated temperatures in the short-term, prolonged exposure to elevated temperatures may result in sublethal and lethal impacts. Bonneau and Scarnecchia (1996) found that in one sub-confluence pool in an Idaho creek with a sharp thermal gradient (8 -15 °C), juvenile bull trout invariably sought the coldest overnight temperatures available (8 - 9 °C), seemingly prioritizing cold water over other habitat characteristics (e.g., water velocity, clarity). In an effort to generalize bull trout temperature preferences across known distributions in the Pacific Northwest, Bruce E Rieman, Chandler, and Martin (1999) found that bull trout appear more abundant at summer mean temperatures of 6 – 9 °C, and no more than 13 - 14 °C. Bull trout densities observed in Gamett (2002) suggest that the optimal thermal range for bull trout is 7 – 8 °C.

Using a 60-day acclimated chronic exposure method to identify lethal limits and optimal growth scenarios for juvenile bull trout, Selong, McMahon, Zale, and Barrows (2001) found the following: no more than 2 percent lethality occurred after 60 days at 8 – 18 °C while 100 percent mortality occurred at after 60 days at 22 - 28 °C; 20.9 °C was the predicted upper incipient lethal limit; peak growth occurred at 13 °C; and Feeding decreased above 16 °C, ceased at 22 °C, and feed efficiency declined at 20 °C. The authors further found that lethality occurred sooner as temperature increased, with 100 percent mortality reached after 24 hours at 26 °C, 10 days at 24 °C, and 38 days at 22 °C.

In addition to the sublethal impacts noted above, Selong et al. (2001) also report elevated temperatures resulting in reduced competitive ability and disease tolerance in bull trout. Elevated temperatures may additionally result in impacts to migration success-, territoriality-, and aggressiveness-related life processes (USEPA, 1999b).

Section 19(4)(iii) of the CDT WQS establishes seasonal (Jun.1 – Sept. 30) temperature standards to protect the Bull Trout and Cutthroat Trout use classification. There are no CDT WQS in effect for Clean Water Act purposes between Oct. 1 and May 31.

There are no CDT WQS in effect for temperature for Clean Water Act purposes between October 1st and May 31st. Thus, the WQS at IDAPA 58.01.02.250.02.b were used as a reference to evaluate reasonable potential for October 1st – May 31st. The Idaho Water Quality Standards designate the St. Joe River, from the St. Maries River to its mouth, for cold water aquatic life. The applicable Idaho water quality standard for waters so designated is: "Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C." EPA has determined that the discharge does not have the reasonable potential to cause or contribute to excursions above the Idaho water quality criteria for temperature, from October – May. During this season, the maximum projected temperature at the edge of the mixing zone is 12.1 °C.

Section 19(4)(iii) of the CDT WQS establishes: "From June 1, through September 30, the 7-day average of the daily maximum temperatures within the hypolimnion is not to exceed 16 °C. In thermally stratified TAS waters the hypolimnetic temperature shall be determined by natural conditions as defined in Section 19(4), (a), (ii), (A) and pursuant to Section 4 of these standards. In TAS waters greater than 15 meters this standard applies to the bottom 80 percent of the lake water column present below the metalimnion. In TAS waters less than 15 meters and greater than 8 meters this standard applies to only the bottom 50 percent of the water column present below the metalimnion. TAS waters exhibiting total water column depths less than 8 meters are not expected to maintain a stable stratified condition and are therefore exempt from this standard."

Outfall 001 discharges on the left bank of the St. Joe River. Near the outfall location, the river is shallower than 8 meters (26 feet) for most of its width, and the portion of the river cross section which is deeper than 8 meters is closer to the right bank. The discharge from Outfall 001 will be warmer than the ambient water and therefore buoyant, and, since it is a side bank discharge, it is likely to attach to the left bank (this behavior is visible in Figure 2). As such, the discharge from Outfall 001 is unlikely to affect temperatures in the deeper portion of the St. Joe River where stratification may develop. Thus, the discharge does not have the reasonable potential to cause or contribute to excursions above water quality standards for temperature from June 1st through September 30th.

Commented [SSP14]: Please provide discussion of the potential for maximum effluent temps (approx. 28 C, Table 7) to increase receiving water temperatures, with respect to seasonal temperature fluctuations and bull trout migratory patterns (e.g., cold winter temps protective of BT could be raised by warm effluent, but BT may not be utilizing the action area during the winter).

For the following reasons, the EPA concludes that temperature in the effluent is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area.

- The Permit includes continuous receiving water and effluent temperature monitoring in the month of June to inform future permitting actions.
- Literature has shown that bull trout can tolerate sub-optimal/elevated temperatures for relatively long periods of time without suffering mortality.
- Given their tendency to favor cooler waters when possible, it is highly unlikely that migrating bull trout would spend much time the action area, thereby mitigating potential sublethal impacts resulting from brief exposure to elevated temperatures.
- Any potential effects resulting from temperature are expected to be short-term, transient, unmeasurable, and therefore insignificant.

Commented [SSP15]: While true, physiological and/or behavioral effects could still be incurred, which are still adverse. This bullet does not support an NLAA determination.

Commented [SSP16]: Mention shallower depths on left bank and likelihood that BT would be utilizing deeper habitat on right back (this would be useful discussion in general to support notion that BT will avoid the mixing zone).

6.3.14 Zinc

Zinc is naturally introduced into aquatic systems, usually via leaching from igneous rocks. Concentrations of zinc associated with unpolluted freshwater systems are estimated to range between 0.5 – 15.0 µg/L (Groth, 1970; Moore & Ramamoorthy, 1984). Most of this naturally introduced zinc is adsorbed to sediments; however, a small amount remains in the water, predominantly in the form of the free Zn^{+2} ion. Release of zinc from sediment is enhanced by the combination of high dissolved oxygen, low salinity, and low pH (Eisler, 1993).

All life forms require zinc as an essential element; however aquatic animals tend to accumulate excess zinc, which can result in growth retardation, hyperchromic anemia, and defective bone mineralization. Zinc primarily affects zinc-dependent enzymes regulating RNA and DNA. Zinc also increases the numbers of metallothioneins, low molecular weight proteins involved in zinc homeostasis (Eisler, 1993).

Aquatic animals tend to accumulate excess zinc, which can result in growth retardation, hyperchromic anemia, and defective bone mineralization. Effects of Zn exposure include undermined immune function and thus compromised disease resistance (Ghanmi, Rouabhia, Othmane, & Deschaux, 1989); impaired respiration, including potentially serious destruction of gill epithelium (Eisler, 1993); modified blood and serum chemistry, enzyme activity and function (Hilmy, Eldomiaty, Daabees, & Latife, 1987a, 1987b); interference with gall bladder and gill metabolism, hyperglycemia, and jaw and branchial abnormalities (Eisler, 1993). The mode of action for Zn toxicity relates to net loss of calcium (Hansen, Welsh, Lipton, Cacela, & Dailey, 2002).

Hansen et al., measured 120-hour lethal concentrations of Zn for bull trout fry. Multiple pairs of tests were performed with a nominal pH of 7.5, hardness of 30 mg/L, and at temperatures of 8 °C to 12.1 °C. The LC50 values for bull trout ranged from 35.6 µg/L to 80.0 µg/L. Zinc toxicity generally increased as water hardness decreased. The authors also report that older, more active juvenile bull trout are more sensitive than younger, more docile juvenile bull trout based on observed changes in behavior at the juvenile life stage, and that the timing of Zn exposure and the activity level of the exposed fish are germane to predicting toxicity in the field. The study also indicated that bull trout appear less sensitive to zinc exposure compared to rainbow trout due to a decreased susceptibility to calcium loss (Hansen et al., 2002).

In addition to the physiological effects of Zn exposure, studies have also documented a variety of behavioral responses. Among these are altered avoidance behavior, decreased swimming ability, and hyperactivity (Eisler, 1993). The author also suggests Zn exposure has implications for growth, reproduction, and survival. Spear (1981) in Eisler (1993) reported decreased swimming ability after 109 days in the juvenile and adult minnow (Phoxinus phoxinus) at concentrations of 160 µg/L and 200 µg/L, respectively. Sprague (1968) USEPA (1980) found that after 10 minutes of exposure to 5.6 µg/L zinc juvenile rainbow trout exhibit avoidance behavior.

For the following reasons, the EPA concludes that the discharge of zinc is NOT likely to adversely affect bull trout or their designated critical habitat in the action area:

- Few trout are expected to occur in the action area.
- Migrating trout are not expected to remain in the discharge plume for long periods of time.
- The effluent limits for zinc will ensure compliance with zinc criteria at the edge of the mixing zones.
- The water quality criteria are below the lowest observed LC50 toxic values for bull trout fry in Hansen et al. (2002).
- LC50 values are based on 120 hours of exposure. It is unlikely that migrating bull trout will remain in the action area for long periods of time.
- Any potential effects resulting from the discharge of zinc are expected to be short-term, transient, unmeasurable, and therefore insignificant.

6.4 Summary of Effects Analysis

Commented [SSP17]: Need more discussion and rationale(s) for effects to critical habitat with respect to the individual PBFs (pg 4-8). Specifically, how water quality/migration barriers, sediment and temperature may be affected and why those effects do not rise to adverse effects.

A literature review revealed that based on habitat needs and preferences, it is highly unlikely that wolverine occur in the action area. Therefore, the EPA has determined that the action will have no effect on the proposed threatened North American Wolverine, and further analysis was not undertaken.

In order to characterize potential impacts to the threatened bull trout and bull trout critical habitat, the EPA performed a literature search to identify potential impacts of pollutants of concern in the effluent on bull trout, contrasted pollutant levels expected to be in the effluent and receiving water against known effects thresholds; and highlighted permit conditions that are expected to mitigate impacts to bull trout and Critical Habitat and better inform future EPA and USFWS actions related to the facility. The analysis revealed that any potential impacts to bull trout in the action area are expected to be short-term, transient, unmeasurable, and therefore insignificant.

It is most likely that any bull trout in the action area are actively migrating between Coeur d'Alene Lake and known habitat in the Upper St. Joe River, rather than remaining in the action area for prolonged periods. It is expected that bull trout will either be able to avoid pollutants in the discharge plume entirely, or in a more conservative scenario, will only briefly be exposed to very dilute pollutant concentrations, resulting in discountable impacts. For these reasons, the EPA has determined that reissuance of the Permit for the PotlatchDeltic St. Maries Complex is not likely to adversely affect bull trout or their designated critical habitat.

7 References

Aiken, D., & Waddy, S. (1990). Winter temperature and spring photoperiod requirements for spawning in the American lobster, Homarus americanus, H. MILNE EDWARDS, 1837. *J. Shellfish Res, 9*, 41-43.

Amelung, M. (1982). EFFECTS OF DISSOLVED IRON COMPOUNDS ON DEVELOPING EGGS AND LARVAE OF SALMO-GAIRDNERI (RICHARDSON). *ARCHIV FUR FISCHEREIWISSENSCHAFT, 32*(1-3), 77-87.

Banci, V. (1994). *The scientific basis for conserving forest carnivores, American marten, fisher, lynx, and wolverine, in the western United States.-USDA Forest Service*. Retrieved from https://www.fs.fed.us/rm/pubs_rm/rm_gtr254/rm_gtr254_099_127.pdf

Batt, P. (1996). *State of Idaho bull trout conservation plan*. Boise, ID Retrieved from https://species.idaho.gov/wp-content/uploads/sites/82/2016/05/bulltroutconservationplan-96.pdf

Biggs, B. J. F. (2000). Eutrophication of streams and rivers: dissolved nutrient-chlorophyll relationships for benthic algae. *Journal of the North American Benthological Society, 19*(1), 17-31. doi:Doi 10.2307/1468279

Birge, W. J., Black, J. A., & Ramey, B. A. (1981). The reproductive toxicology of aquatic contaminants. *Hazard assessment of chemicals: Current developments, 1*, 59-67.

Birge, W. J., Black., J. A., & Black, J. A. (1977). *Sensitivity of vertebrate embryos to boron compounds : April 1977 : final report*. (EPA-560/1-76-008

EPA-68-01-3222

PB267085

EPA 560-1-76-008

PB-267 085). Washington, D.C.: Office of Toxic Substances, Environmental Protection Agency Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20012HI6.PDF

Birtwell, I. K. (1989). Comments on the sensitivity of salmonids to reduced levels of dissolved oxygen, and to pulp mill pollution in Neroutsos Inlet, British Columbia.

Bjornn, T., & Reiser, D. (1991). Habitat requirements of salmonids in streams. *American Fisheries Society Special Publication, 19*(837), 138.

Black, J. A., Barnum, J. B., & Birge, W. J. (1993). An integrated assessment of the biological effects of boron to the rainbow trout. *Chemosphere, 26*(7), 1383-1413. doi:https://doi.org/10.1016/0045-6535(93)90189-C

Bonneau, J. L., & Scarnecchia, D. L. (1996). Distribution of juvenile bull trout in a thermal gradient of a plunge pool in Granite Creek, Idaho. *Transactions of the American Fisheries Society, 125*(4), 628-630. doi:Doi 10.1577/1548-8659(1996)125<0628:Dojbti>2.3.Co;2

Borgmann, U., Couillard, Y., Doyle, P., & Dixon, D. G. (2005). Toxicity of sixty-three metals and metalloids to Hyalella azteca at two levels of water hardness. *Environmental Toxicology and Chemistry, 24*(3), 641-652. doi:Doi 10.1897/04-177r.1

BPA, USBR, & USACE. (1999). *Multi-Species Biological Assessment of the Federal Columbia River Power System*. Retrieved from https://www.usbr.gov/pn/fcrps/documents/1999ba.pdf

Brenner, F. J., & Cooper, W. L. (1978). Effect of suspended iron hydroxide on the hatchability and embryonic development of the coho salmon.

Brinkman, S. F., Woodling, J. D., Vajda, A. M., & Norris, D. O. (2009). Chronic Toxicity of Ammonia to Early Life Stage Rainbow Trout. *Transactions of the American Fisheries Society, 138*(2), 433-440. doi:10.1577/T07-224.1

Cadmus, P., Brinkman, S. F., & May, M. K. (2018). Chronic Toxicity of Ferric Iron for North American Aquatic Organisms: Derivation of a Chronic Water Quality Criterion Using Single Species and Mesocosm Data. *Archives of Environmental Contamination and Toxicology, 74*(4), 605-615. doi:10.1007/s00244-018-0505-2

CDT, & Avista. (2004, 2004). Bathymetry for the Coeur d'Alene River Basin, Idaho. Retrieved from https://www.arcgis.com/home/item.html?id=fe84410fca514d29a644e12674e7b2d1

Constable, M., Charlton, M., Jensen, F., McDonald, K., Craig, G., & Taylor, K. W. (2003). An ecological risk assessment of ammonia in the aquatic environment. *Human and Ecological Risk Assessment, 9*(2), 527-548. doi:Doi 10.1080/713609921

Davis, J. C. (1975). Minimal Dissolved-Oxygen Requirements of Aquatic Life with Emphasis on Canadian Species - Review. *Journal of the Fisheries Research Board of Canada, 32*(12), 2295-2332. doi:DOI 10.1139/f75-268

Davis, J. C. (1975). Waterborne dissolved oxygen requirements and criteria with particular emphasis on the Canadian environment.

deHoop, C. F., Einsel, D. A., Ro, K. S., Chen, S., Gibson, M. D., & Grozdits, G. A. (1998). Stormwater runoff quality of a louisiana log storage and handling facility. *Journal of Environmental Science and Health, Part A, 33*(2), 165-177. doi:10.1080/10934529809376725

Donald, D. B., & Alger, D. J. (1993). Geographic-Distribution, Species Displacement, and Niche Overlap for Lake Trout and Bull Trout in Mountain Lakes. *Canadian Journal of Zoology-Revue Canadienne De Zoologie, 71*(2), 238-247. doi:DOI 10.1139/z93-034

Dunham, J. B., & Rieman, B. E. (1999). Metapopulation structure of bull trout: Influences of physical, biotic, and geometrical landscape characteristics. *Ecological Applications, 9*(2), 642-655. doi:Doi 10.2307/2641151

Eisler, R. (1990). *Boron Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*. Retrieved from

Eisler, R. (1993). *Zinc Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review*. Retrieved from

Fraley, J. J., & Shepard, B. B. (1989). Life-History, Ecology and Population Status of Migratory Bull Trout (Salvelinus-Confluentus) in the Flathead Lake and River System, Montana. *Northwest Science, 63*(4), 133-143. Retrieved from <Go to ISI>://WOS:A1989AT02400001

Fry, F. (1971). *The effect of environmental factors on the physiology of fish*.

Gamett, B. L. (2002). *The relationship between water temperature and bull trout distribution and abundance.* Utah State University, Department of Fisheries and Wildlife,

Ghanmi, Z., Rouabhia, M., Othmane, O., & Deschaux, P. A. (1989). Effects of Metal-Ions on Cyprinid Fish Immune-Response - Invitro Effects of Zn-2+ and Mn-2+ on the Mitogenic Response of Carp Pronephros Lymphocytes. *Ecotoxicology and Environmental Safety, 17*(2), 183-189. doi:Doi 10.1016/0147-6513(89)90037-7

Goetz, F. (1989). *Biology of the bull trout, a literature review*. Eugene, Oregon

Groth, P. (1970). *Untersuchung über einige Spurenelemente im Seen*.

Hansen, J. A., Welsh, P. G., Lipton, J., Cacela, D., & Dailey, A. D. (2002). Relative sensitivity of bull trout (Salvelinus confluentus) and rainbow trout (Oncorhynchus mykiss) to acute exposures of cadmium and zinc. *Environmental Toxicology and Chemistry, 21*(1), 67-75. doi:10.1897/1551-5028(2002)021<0067:Rsobts>2.0.Co;2

Harry, H., & Aldrich, D. (1963). The distress syndrome in Taphius glabratus (Say) as a reaction to toxic concentrations of inorganic ions. *Malacologia, 1*(2), 283-289.

Hash, H. S. (1987). Wolverine. In M. Novak, Baker, JA, Obbard, ME & Malloch, B. (Ed.), *Wild Furbearer Management In North America* (pp. 574-585).

Hem, J., & Cropper, W. (1962). *Chemistry of iron in natural water*. Retrieved from

Hicks, M. (2002). *Evaluating criteria for the protection of freshwater aquatic life in Washington's surface water quality standards: dissolved oxygen (draft discussion paper and literature summary)*. Retrieved from https://fortress.wa.gov/ecy/publications/SummaryPages/0010071.html

High, B., Meyer, K. A., Schill, D. J., & Mamer, E. R. J. (2008). Distribution, Abundance, and Population Trends of Bull Trout in Idaho. *North American Journal of Fisheries Management, 28*(6), 1687-1701. doi:10.1577/M06-164.1

Hillman, T., & Essig, D. (1998). *Review of bull trout temperature requirements: a response to the EPA bull trout temperature rule*. Retrieved from Boise, Idaho: https://www.deq.idaho.gov/media/528739-bulltrout_98.pdf

Hilmy, A. M., Eldomiaty, N. A., Daabees, A. Y., & Latife, H. A. A. (1987a). Some Physiological and Biochemical Indexes of Zinc Toxicity in 2 Fresh-Water Fishes, Clarias-Lazera and Tilapia-Zilli. *Comparative Biochemistry and Physiology C-Pharmacology Toxicology & Endocrinology, 87*(2), 297-301. doi:Doi 10.1016/0742-8413(87)90011-9

Hilmy, A. M., Eldomiaty, N. A., Daabees, A. Y., & Latife, H. A. A. (1987b). Toxicity in Tilapia-Zilli and Clarias-Lazera (Pisces) Induced by Zinc, Seasonally. *Comparative Biochemistry and Physiology C-Pharmacology Toxicology & Endocrinology, 86*(2), 263-265. doi:Doi 10.1016/0742-8413(87)90077-6

Hoelscher, B., & Bjornn, T. (1989). *Habitat, densities, and potential production of trout and char in Pend Oreille Lake Tributaries. Idaho Department of Fish and Game, Job Completion Report*. Retrieved from

Hornocker, M. G., & Hash, H. S. (1981). Ecology of the Wolverine in Northwestern Montana. *Canadian Journal of Zoology-Revue Canadienne De Zoologie, 59*(7), 1286-1301. doi:DOI 10.1139/z81-181

Houston, A. H. (1982). *Thermal effects upon fishes*. Retrieved from Ottawa:

Howell, P., & Buchanan, D. V. (1992). *Proceedings of the Gearhart Mountain Bull Trout Workshop.* Paper presented at the American Fisheries Society (USA). Oregon Chapter. Gearhart Mountain Bull Trout Workshop. Gearhart Mountain Wilderness, Or.(USA). 1989.

IDEQ. (2008). *Potlatch River Subbasin Assessment and TMDLs*. Lewiston, ID: Idaho Department of Environmental Quality Lewiston Regional Office Retrieved from https://www.deq.idaho.gov/media/464337-potlatch_river_entire.pdf

IDEQ. (2011). *St. Joe River Subbasin Temperature Total Maximum Daily Loads: Addendum to the St. Joe River Subbasin Assessment and Total Maximum Daily Loads and St. Maries River Subbasin Assessment and Total Maximum Daily Loads*. Coeur d'Alene, ID

Boise, ID: Idaho Department of Environmental Quality Retrieved from http://www.deq.idaho.gov/media/726477-st-joe-river-subbasin-temperature-tmdl-addendum-0911.pdf

IDEQ. (2020). Idaho NHDPlus Ver. 2 Flowline Value Added Attributes: Reach Code: 17010304000045. Retrieved from https://mapcase.deq.idaho.gov/nhd/nhdplus.aspx?COMID=23003855

IDEQ&CdAT. (2009). *Coeur d'Alene Lake Management Plan*. Retrieved from https://www.deq.idaho.gov/media/468377-_water_data_reports_surface_water_water_bodies_cda_lake_mgmt_plan_final_2009.pdf

Isaak, D., Young, M., Nagel, D., Horan, D., Groce, M., & Parkes, S. (2017). *Climate Shield bull trout and cutthroat trout population occurrence scenarios for the western US Rocky Mountain Research Station*.

Lowery, E. D., & Beauchamp, D. A. (2015). Trophic Ontogeny of Fluvial Bull Trout and Seasonal Predation on Pacific Salmon in a Riverine Food Web. *Transactions of the American Fisheries Society, 144*(4), 724-741. doi:10.1080/00028487.2015.1035452

McGrath, C., Woods, A., Omernik, J., Bryce, S., Edmondson, M., Nesser, J., . . . Plocher, M. (2002). Ecoregions of Idaho (color poster with map, descriptive text, summary tables, and photographs). *US Geological Survey, Reston, VA, 1*(1350), 000.

Moore, J., & Ramamoorthy, S. (1984). *Heavy Metals in Natural Waters*.

Newcombe, C. P., & Jensen, J. O. T. (1996). Channel Suspended Sediment and Fisheries: A Synthesis for Quantitative Assessment of Risk and Impact. *North American Journal of Fisheries Management, 16*(4), 693-727. doi:10.1577/1548-8675(1996)016<0693:CSSAFA>2.3.CO;2

Poole, G., Dunham, J., Hicks, M., Keenan, D., Lockwood, J., Materna, E., . . . Sauter, S. (2001). *Technical synthesis: scientific issues relating to temperature criteria for salmon, trout, and char native to the Pacific Northwest*. Seattle, WA

Pratt, K. (1992). *A review of bull trout life history.* Paper presented at the Proceedings of the Gearhart Mountain bull trout workshop. Oregon Chapter of the American Fisheries Society, Corvallis.

Rama Rao, S. V., & Nath, K. J. (1983). Biological effect of some poisons on Canthocamptus (Crustacea spp). *International Journal of Environmental Studies, 21*(3-4), 271-275. doi:10.1080/00207238308710085

Randall, D. J., & Smith, J. C. (1967). The Regulation of Cardiac Activity in Fish in a Hypoxic Environment. *Physiological Zoology, 40*(2), 104-113. doi:10.1086/physzool.40.2.30152445

Rieman, B. E., Chandler, G. L., & Martin, D. M. (1999). *Empirical evaluation of temperature effects on bull trout distribution in the Northwest*. Retrieved from Boise, ID:

Rieman, B. E., Lee, D. C., & Thurow, R. F. (1997). Distribution, Status, and Likely Future Trends of Bull Trout within the Columbia River and Klamath River Basins. *North American Journal of Fisheries Management, 17*(4), 1111-1125. doi:10.1577/1548-8675(1997)017<1111:DSALFT>2.3.CO;2

Rieman, B. E., & McIntyre, J. D. (1993). *Demographic and habitat requirements for conservation of bull trout*. (INT-302). Retrieved from https://www.fs.usda.gov/treesearch/pubs/29778

Rieman, B. E., & McIntyre, J. D. (1995). Occurrence of Bull Trout in Naturally Fragmented Habitat Patches of Varied Size. *Transactions of the American Fisheries Society, 124*(3), 285-296. doi:10.1577/1548-8659(1995)124<0285:Oobtin>2.3.Co;2

Sedell, J., & Everest, F. (1991). *Historic changes in pool habitat for Columbia River Basin salmon under study for TES listing. Draft US Department of Agriculture Report*. Retrieved from

Selong, J. H., McMahon, T. E., Zale, A. V., & Barrows, F. T. (2001). Effect of Temperature on Growth and Survival of Bull Trout, with Application of an Improved Method for Determining Thermal Tolerance in Fishes. *Transactions of the American Fisheries Society, 130*(6), 1026-1037. doi:10.1577/1548-8659(2001)130<1026:EOTOGA>2.0.CO;2

Smith, E. J., & Sykora, J. L. (1976). Early Developmental Effects of Lime-Neutralized Iron Hydroxide Suspensions on Brook Trout and Coho Salmon. *Transactions of the American Fisheries Society, 105*(2), 308-312. doi:10.1577/1548-8659(1976)105<308:EDEOLI>2.0.CO;2

Smith, V. H., & Schindler, D. W. (2009). Eutrophication science: where do we go from here? *Trends in Ecology & Evolution, 24*(4), 201-207. doi:10.1016/j.tree.2008.11.009

Somero, G. N., & Hochachka, P. W. (1971). Biochemical adaptation to the environment. *American Zoologist, 11*(1), 159-167.

Spear, P. (1981). Zinc in the Aquatic Environment; Chemistry, Distribution And Toxicology. National Research Council of Canada, Associate Committee on Scientific Criteria for Environmental Quality. *Report NRCC No 17589, Ottawa*.

Sprague, J. B. (1968). Avoidance reactions of rainbow trout to zinc sulphate solutions. *Water Research, 2*(5), 367-372. doi:https://doi.org/10.1016/0043-1354(68)90048-1

Strickland, J. (1965). Production of organic matter in the primary stages of the marine food chain. *Chemical Oceanography.*, 477-610.

Sykora, J., Smith, E., Synak, M., & Shapiro, M. (1975). Some observations on spawning of brook trout (Salvelinus Fontinalis, mitchill) in lime neutralized iron hydroxide suspensions. *Water Research, 9*(4), 451-458.
Sykora, J. L., Smith, E. J., & Synak, M. (1972). Effect of lime neutralized iron hydroxide suspensions on juvenile brook trout (salvelinus fontinalis, mitchill). *Water Research, 6*(8), 935-950. doi:https://doi.org/10.1016/0043-1354(72)90045-0
Thompson, R., & Newell, R. (1985). *Physiological responses to temperature in two latitudinally separated populations of the mussel, Mytilus edulis*.
Thurston, R. V., Russo, R. C., & Vinogradov, G. A. (1981). Ammonia Toxicity to Fishes - Effect of Ph on the Toxicity of the Un-Ionized Ammonia Species. *Environmental Science & Technology, 15*(7), 837-840. doi:DOI 10.1021/es00089a012
Updegraff, K. F., & Sykora, J. L. (1976). Avoidance of lime-neutralized iron hydroxide solutions by coho salmon in the laboratory. *Environmental Science & Technology, 10*(1), 51-54.
USACE. (2017). *Rehabilitation of flood control works, St. Maries Federal Levee St. Maries, Idaho: Finding of no significant impact*. U.S. Army Corps of Engineers, Seattle District Retrieved from https://usace.contentdm.oclc.org/digital/collection/p16021coll7/id/10076/
USDA. (2018). *Coeur d'Alene Basin Restoration Plan and Environmental Impact Statement*. Missoula, MT Retrieved from https://www.fs.usda.gov/nfs/11558/www/nepa/96855_FSPLT3_4247039.pdf
USEPA. (1976). *Quality criteria for water*. (EPA 440-R-76-001

EPA 440-9-76-023

EPA-440-9-76-023

TD223.U52 1976

EPA 440/9-76-023

EPA 440/R-76-001

EPA/440/9-76-023

PB-263 943). Washington: U.S. Environmental Protection Agency Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=2000IYMP.PDF

https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1008F64.PDF
USEPA. (1980). *Ambient water quality criteria for zinc*. (EPA 440/5-80-079

EPA-440-5-80-079

EPA 440-5-80-079

EPA/440/5-80/079

PB81-117897). Washington, DC Springfield, Virginia: United States Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division, Available to the public through the National Technical Information Service Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=2000LNKE.PDF
USEPA. (1986a). *Ambient aquatic life water quality criteria for dissolved oxygen : (freshwater)*. (EPA/440/5-86-003

PB86208253

EPA 440/5-86-003

EPA 440-5-86-003

EPA/440/5-86/003

PB86-208253). Washington, DC: U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Criteria and Standards Division Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=00001MSS.PDF

USEPA. (1986b). *Quality criteria for water, 1986*. Washington, DC: United States. Environmental Protection Agency. Office of Water Regulations and Standards.

U.S. Environmental Protection Agency, Office of Water Regulations and Standards : [For sale by the Supt. of Docs., U.S. G.P.O.

USEPA. (1991). *Technical support document for water quality-based toxics control*. Environmental Protection Agency, Washington, DC. Office of the Assistant Administrator for Water.

Office of Water Enforcement and Permits : Office of Water Regulations and Standards, U.S. Environmental Protection Agency Retrieved from http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=100002CU.PDF

USEPA. (1999a). *1999 Update of ambient water quality criteria for ammonia*. (EPA 822-R-99-014

EPA/822-R-99-014

EPA 822/R-99-014

EPA-822-R-99-014

PB2005-109112). Washington, D.C.: U.S. Environmental Protection Agency, Office of Water Retrieved from https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=20003O3L.PDF

USEPA. (1999b). *A review and synthesis of effects of alterations to the water temperature regime on freshwater life stages of salmonids, with special reference to Chinook salmon*. US Environmental Protection Agency, Region 10 Retrieved from https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1004JG1.txt

USEPA. (2018). *Region 4 Ecological Risk Assessment Supplemental Guidance: March 2018 Update*. Retrieved from https://www.epa.gov/sites/production/files/2018-03/documents/era_regional_supplemental_guidance_report-march-2018_update.pdf

USEPA. (2020a). *Biological Evaluation of Freshwater Aluminum Water Quality Criteria for Oregon*. Seattle, WA

USEPA. (2020b). Nutrient Pollution: Sources and Solutions. Retrieved from https://www.epa.gov/nutrientpollution/sources-and-solutions

USFWS. (1998). Bull Trout Facts. In U. F. a. W. Service (Ed.). Portland, OR: US Fish and Wildlife Service Public Affairs Office.

USFWS. (2009). *Bull Trout Proposed Critical Habitat Justification: Rationale for Why Habitat is Essential, and Documentation of Occupancy*. Portland, OR Retrieved from https://www.fws.gov/pacific/bulltrout/pdf/Updated%20Final%20Appendix%202.pdf

USFWS. (2011). *U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: Gulo gulo luscus*. Retrieved from https://www.fs.fed.us/r6/sfpnw/issssp/documents2/cp-fws-candidate-ma-gulo-gulo-luscus-2011-10.pdf

USFWS. (2014). Final Critical Habitat GIS Data. Retrieved from https://www.fws.gov/pacific/bulltrout/Habitat.cfm

USFWS. (2015a). *Columbia Headwaters Unit Implementation Plan for Bull Trout (Salvelinus confluentus)*. Kalispell, MT

Spokane, WA: USFWS Retrieved from https://www.fws.gov/pacific/bulltrout/pdf/Final_Columbia_Headwaters_RUIP_092915.pdf

USFWS. (2015b). *Recovery Plan for the Coterminous United States Population of Bull Trout*. Portland, Oregon Retrieved from https://www.fws.gov/pacific/bulltrout/pdf/Final_Bull_Trout_Recovery_Plan_092915.pdf

Vitale, A., Roberts, F., & Peters, R. (2002). *Coeur d'Alene Tribe Fish and Wildlife Program Habitat Protection Plan; Implementation of Fisheries Enhancement Opportunities on the Coeur d'Alene Reservation, 1997-2002 Technical Report* (DOE/BP-00010885-6; R&D Project: 1990-044-00; TRN: US200915%%342 United States 10.2172/961902 R&D Project: 1990-044-00; TRN: US200915%%342 BPA English). Retrieved from https://www.osti.gov/servlets/purl/961902

Watson, G., & Hillman, T. W. (1997). Factors Affecting the Distribution and Abundance of Bull Trout: An Investigation at Hierarchical Scales. *North American Journal of Fisheries Management, 17*(2), 237-252. doi:10.1577/1548-8675(1997)017<0237:FATDAA>2.3.CO;2

Weaver, T., & White, R. (1985). *Coal Creek Fisheries Monitoring Study No. III. Quarterly Progress Report*.

Whitehouse, B. G. (1984). The Effects of Temperature and Salinity on the Aqueous Solubility of Polynuclear Aromatic-Hydrocarbons. *Marine Chemistry, 14*(4), 319-332. doi:Doi 10.1016/0304-4203(84)90028-8

Wilson, D. E. (1982). Wolverine. In J. Chapman & G. Feldhamer (Eds.), *Wild mammals of North America: biology, management, and economics* (pp. 1147). Baltimore, Md: Johns Hopkins University Press.

Yang, X. E., Wu, X., Hao, H. L., & He, Z. L. (2008). Mechanisms and assessment of water eutrophication. *Journal of Zhejiang University-Science B, 9*(3), 197-209. doi:10.1631/jzus.B0710626

Young, M. K., Isaak, D. J., McKelvey, K. S., Schwartz, M. K., Carim, K. J., Fredenberg, W., . . . Wollrab, S. P. (2017). *Species occurrence data from the Range-Wide Bull Trout eDNA Project*. Fort Collins, CO Retrieved from https://www.fs.usda.gov/rds/archive/Catalog/RDS-2017-0038